UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

MINERAL RESOURCES OF THE TRACY ARM-FORDS TERROR WILDERNESS STUDY AREA AND VICINITY, ALASKA

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STUDIES RELATED TO WILDERNESS-STUDY AREAS

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STUDIES RELATED TO WILDERNESS STUDY AREAS

In accordance with the provisions of the Wilderness Act (Public Law 88-577, September 3, 1964) and the Joint Conference Report on Senate Bill 4, 88th Congress, the U.S. Geological Survey and U.S. Bureau of Mines have been conducting mineral surveys of wilderness and primitive areas. Studies and reports of all primitive areas have been completed. Areas officially designated as "wilderness", "wild", or "canoe" when the Act was passed were incorporated into the National Wilderness Preservation System, and some of them are presently being studied. The Act provided that areas under consideration for wilderness designation should be studied for suitability for incorporation into the Wilderness System. The mineral surveys constitute one aspect of the suitability studies. This report discusses the results of a mineral survey of some national forest lands in the Tracy Arm-Fords Terror study area, Alaska, that are being considered for wilderness designation and of some adjoining lands that may come under discussion when the area is considered. The area studied is between tidewater and the International Boundary in the Coast Range southeast of Juneau in southeastern Alaska.

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Studies related to wilderness--primitive areas

Mineral resources of the Tracy Arm Fords Terror
Wilderness Study Area and vicinity, Alaska

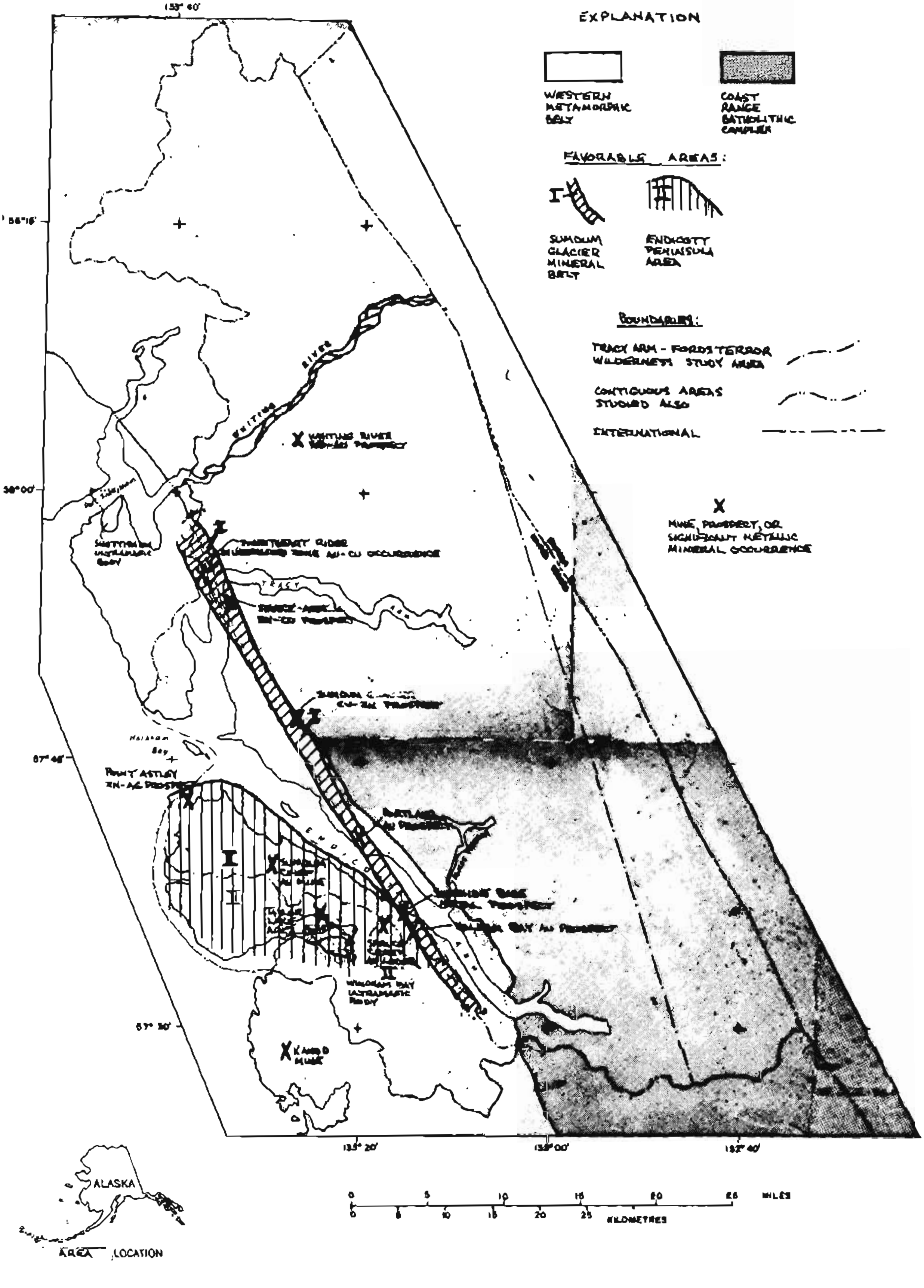
Summary

By David A. Brew, A. L. Kimball, Donald Grybeck, and Jan C. Still

The Wilderness Study Area consists of about 322,300 hectares (1,250 square miles or 796,400 acres) on the southwest side of the Coast Range in southeastern Alaska about 72 km (45 miles) southeast of Juneau, Alaska (fig. 1). An additional 142,800 hectares (550 square miles or 352,900

Figure 1 near here

acres) lying in part between the study area and the International Boundary and in part contiguous to the southwest of the study area were studied because of their importance to the evaluation of the study area itself. Unless otherwise specified, the term Study Area as used in this report includes both the formally designated study area and these contiguous areas. The general area is one of spectacular scenery, with fiords, forests, glacier-covered peaks to 2,470 m (8,095 feet) high, tidewater glaciers, icebergs, and some broad river valleys. No roads or maintained trails or permanent residents are present, and access is only by specially arranged water or air transport. Present human use of the area is related to recreation or mineral-resource exploration.



EXPLANATION
WESTERN METAMORPHIC BELT
COAST RANGE BATHOLITHIC COMPLEX
FAVORABLE AREAS:
SUMDUM GLACIER MINERAL BELT
ENDICOTT PENINSULA AREA
BOUNDARIES:
TRACY ARM - FORDS TERROR WILDERNESS STUDY AREA
CONTIGUOUS AREAS STUDIED ALSO
INTERNATIONAL
MINE, PROPERTY, OR SIGNIFICANT METALLIC MINERAL OCCURRENCE
WHITING RIVER
POINT ASTLEY ZN-AG PROSPECT
133° 20'
133° 00'
132° 40'
57° 30'
57° 45'
58° 00'
0 5 10 15 20 25 MILES
0 5 10 15 20 25 KILOMETRES
ALASKA
AREA LOCATION

Figure 1.--Map of Tracy Arm-Fords Terror Wilderness Study Area, southeastern Alaska, showing western metamorphic belt, Coast Range batholithic complex, major known metallic mineral occurrences, and areas favorable for metallic mineral occurrences.

This report presents pertinent geological, geochemical, geophysical, and mining engineering information derived from a joint U.S. Geological Survey-U.S. Bureau of Mines study of the area conducted from 1972 to 1975. It also synthesizes this information to evaluate the mineral potential of two areas of significant potential, the Sumdum Glacier mineral belt and the Endicott Peninsula area, as well as other areas of low potential.

Geochemical investigations by the Geological Survey included sampling, analysis, and interpretation of both active stream sediments and bedrock; 792 stream-sediment samples and 4,228 bedrock samples were collected, processed, and analyzed. Statistical analysis of the geochemical data, with the aid of a computer, was used to identify significant anomalous analytical values. A total of 138 stream-sediment samples and 262 bedrock samples were identified as containing anomalous amounts of one or more significant elements.

Mining engineering studies by the Bureau of Mines included mining claim records search; on-site claim, mine, and prospect investigations; and mapping and sampling of stained zones, altered zones, and geochemically anomalous sites. Nearly 1,300 measured quantitative samples were collected, analyzed, and interpreted. More than two dozen underground workings with a cumulative length of about a mile were samples and most were also mapped.

About 670 claims, about 90 percent of them lode, are recorded as being within the area studied. Seventy percent of these are within the study area proper. Of these, 97 were active in 1975. Approximately 24,000 ounces of gold and probably a similar quantity of silver were produced from the Sumdum Chief lode property at the turn of the century. Little other production from the area can be verified although some did occur.

Almost all of the mineralization within the Wilderness Study Area occurs in the western metamorphic belt parallel and adjacent to the southwestern side of the Coast Range batholithic complex. Little significant mineralization appears to be present in the Coast Range complex.

The western metamorphic belt has been recognized as having significant mineral potential since the early 1900's. Many of the occurrences investigated have been known since that time, or earlier. The present study has identified two areas of mineral-resource potential for gold, copper, zinc, and silver within this belt in the study area; these are, in the order of decreasing importance: 1) the Sumdum Glacier mineral belt, and 2) the Endicott Peninsula area (fig. 1). Several deposits with gross in place metal values great enough to attract serious exploration are probably present. Most of these individual deposits probably have gross in place values in the range of $1 million to $10 million at February, 1976 prices. Even though the remaining parts of the western metamorphic belt are not discussed specifically, they also have lesser, but undefined, mineral-resource potential.

The Sumdum Glacier mineral belt extends for about 52 km (32 miles) along the southwest side of the Coast Range batholithic complex and contains three known important mineralized areas: the newly discovered Sweetheart Ridge mineralized zone gold-copper occurrence, the Tracy Arm zinc-copper prospect, and the Sumdum copper-zinc prospect. The deposits in the belt consist of pyrrhotite, chalcopyrite, sphalerite, pyrite, galena, and some gold in lenses and pods parallel the foliation or disseminated in the metamorphic rocks.

These three deposits have economic potential and warrant further exploration. They are considered likely to attract commercial interest. The Tracy Arm zinc-copper deposit is estimated to contain 169,000 metric tons (187,000 tons) of inferred ore averaging 3.42 percent zinc, 1.42 percent copper, 14.7 g/metric ton (0.43 oz/ton) silver, and 0.27 g/metric ton (0.008 oz/ton) gold. At February, 1976 prices, the deposit probably has a gross in place combined metal value between $1 million and $10 million.

The Sumdum copper-zinc prospect is estimated to contain 24.2 million metric tons (26.7 million tons) of inferred ore averaging 0.57 percent copper, 0.37 percent zinc, and 10.3 g/metric ton (0.30 oz/ton) silver. A 44.8 m (147-foot-) long portion of the Sweetheart Ridge mineralized zone is estimated to contain 6,600 metric tons (7,300 tons) of inferred ore per 30 m (100 feet) of depth that average 78 g/metric ton (0.23 ounces per ton) in gold and 0.7 percent copper.

The entire Sumdum Glacier mineral belt is considered favorable ground for the occurrence of mineral deposits and the available information is used to 1) arrive at a range for the number of significant deposits that are probable in the belt and 2)estimate the range of total gross in place value probable in the belt.

The three known deposits indicate 1) the minimum number of significant deposits in the belt, and 2) the lower limit of size, grade, etc., that is likely to attract serious attention from prospective developers; i.e., smaller, lower grade, less minable, lesser gross value deposits are not likely to be attractive.

We estimate that, due mainly to timber and brush cover and to the limited usefulness of our geochemical studies, only about 20 percent of the belt has been examined closely enough to find deposits that are similar in size to the three known major deposits and exposed on the surface. Assuming the same deposit density in the remaining 80 percent of the belt, 12 more similar outcropping deposits are probable in the area. We suggest, therefore, that the number of deposits of at least minimum attractive size and value is somewhere between 3 and 15. Note, however, that there may only actually be those three that have been found, and that 15 is not necessarily the upper limit. The 12 could include some of the already-known but relatively unexplored deposits in the belt. This simple model does not consider non-outcropping deposits.

Using the accepted U.S. Bureau of Mines-U.S. Geological Survey mineral resource classification terms, the authors estimate that the belt contains the following gross in-place values of metallic mineral resources: $15 million of identified paramarginal resources, $325 million of identified submarginal resources, and it may also contain $120 million of hypothetical resources. The first two figures are based on the three known deposits and the last figure is based on the assumption that most of the undiscovered deposits are in the $1 million-$10 million range.

The broad Endicott Peninsula area (fig. 1) has been prospected since before 1869 and several occurrences have long been known; namely, the Point Astley zinc-silver deposit, the Sumdum Chief gold mine, the Taylor Lake area prospects, the Holkam Bay gold prospect, and the Windham Bay area gold lodes and placers. The deposits in the area are largely either sulfide minerals disseminated through or in lenses and stringers along the foliation in phyllite or gold-bearing quartz veins in shaly limestone, limy slate, or phyllite. The area, as a whole, is poorly exposed because of extensive timber and brush.

The one known significant deposit in the area consisted of the gold-bearing quartz veins in shaly limestone of the now-mined-out Sumdum Chief gold mine; before 1905 it produced about 24,000 ounces of gold from ore with about 0.4 oz/ton gold. The other prospects and mines either had no or practically no production. The Taylor Lake occurrences are geologically similar to the Sumdum Chief. The Point Astley zinc-silver prospect has not been thoroughly explored. The deposit appears to be extremely irregular and the lateral and vertical continuity of the mineralized zones are not known. The mines and prospects near Windham Bay occur mainly along quartz stringers in broad altered zones and all appear to have low gold contents that only rarely exceed 9 g/metric ton (0.25 oz/ton). The Holkam Bay prospect is similar and had some small production. None of these deposits appear likely to be attractive under present or near-future economic conditions, but some may warrant additional exploration.

The study area has little or no potential for radioactive minerals, tungsten, beryllium, oil, gas, coal, or industrial mineral deposits or as a geothermal energy source.

Geologically, the area spans most of the Coast Range batholithic complex and the rocks adjacent to it on the southwest. The area is divided along a north-northwest line by a long foliated tonalite sill of Cretaceous(?) age (fig. 1). The sill is considered part of the batholithic complex; to its northeast lies the main part of the complex, consisting of a broad terrane of complexly deformed amphibolite facies gneiss, marble, and some schist of uncertain, but probably original Late Paleozoic and(or) Mesozoic age. Near the International Boundary this terrane is intruded by a series of generally unfoliated granodiorite bodies of mid-Tertiary age which are locally associated with migmatite zones.

To the southwest of the sill is the western metamorphic belt, consisting of metamorphic rocks which are locally intruded by granitic and other rocks, including one ultramafic body (fig. 1). Immediately adjacent to the sill are amphibolite facies highly deformed gneiss, schist, quartzite, and calc-silicate rock. The Sumdum Glacier mineral belt is largely within these rocks. To the southwest the metamorphic grade diminishes abruptly and complexly deformed greenschist-facies phyllite, slate, greenschist, and some limestone and quartzite are exposed over most of the remainder of the area, including the Endicott Peninsula area. The original ages of these rocks are uncertain, but they are at least in part Late Paleozoic (Permian) and some are probably Mesozoic in age.

Two persistent major linear features are found in the study area. The largest, the Coast Range megalineament, (fig. 1), is a 3- to 13-km- (2- to 8-mile-) wide zone of closely spaced prominent joints, foliation surfaces, and small faults that roughly parallel the north-northwest-striking foliation along lower Tracy Arm and lower Endicott Arm where they join Holkam Bay. The other, the northeast-trending Whiting River-Sweetheart Lake lineament, consists of two near-parallel northeast-striking lineaments extending from the Snettisham Peninsula across Gilbert Bay up the Whiting River to near the International Boundary. Neither linear feature appears to have mineral resource significance.

Interpretation of aeromagnetic data shows that the igneous intrusive rocks are the most magnetic rocks in the area. The metamorphic rocks of the western metamorphic belt appear to be essentially nonmagnetic and most of the metamorphic rocks and migmatites of the Coast Range batholithic complex are essentially nonmagnetic.

A smooth pattern of low-amplitude, long-wavelength magnetic anomalies over the western metamorphic belt reflects the relatively nonmagnetic character of most of the underlying rocks. Four sharp local magnetic anomalies are present: three of these occur over the surface exposures of ultramafic rocks at Port Snettisham, the Midway Islands, and Windham Bay. The first two anomalies are outside of the area studied. Comparison of the similarly shaped Port Snettisham and Windham Bay anomalies shows a significant difference in amplitude caused by the considerably lower percentage of magnetic minerals in the Windham Bay body. The fourth anomaly, located east of Windham Bay and near known gold occurrences, is thought to be caused by a narrow vertical granitic dike reaching within about 700 m (2,300 feet) of the surface at its shallowest point.

A discontinuous magnetic high associated with the sill that marks the western edge of the batholithic complex causes the steep magnetic gradient between the western metamorphic belt and the complex. Calculations indicate that the southwestern face of the sill is nearly vertical and extends to considerable depth below the surface.

The gravity field in the study area is dominated by a prominent belt of subparallel contours that approximately coincides with the western edge of the Coast Range complex. This steepening of the regional gradient from high positive Bouguer gravities near the continental margin to low values along the International Boundary is probably due to a combination of crustal thickening, topographic effects, and an abrupt decrease in rock densities.

The steep gradients in both the magnetic and gravity fields coincide with the Sumdum Glacier mineral belt.

Introduction

By

David A. Brew and Arthur L. Kimball

The Tracy Arm-Fords Terror Wilderness Study Area covers about 322,300 hectares (1,250 square miles or 796,400 acres) of rugged mountain and fiord terrain along the southwest side of the Coast Range in southeastern Alaska (fig. 1). This report describes the geology and evaluates the mineral-resource potential of the study area proper and of an adjacent 142,800 hectares (550 square miles or 352,900 acres), some 44,000 hectares (170 square miles) of which lie between the national forest lands of the study area and the International Boundary and the rest of which lie between the study area and tidewater to the southwest. For convenience, the term study area as used in this report includes both the study area proper and the contiguous areas.

Part of the area studied has been previously identified by the U.S. Forest Service as the Tracy Arm-Fords Terror Scenic Area because of the spectacular juxtaposition of steep-sided fiords, precipitous glacier-clad peaks, tidewater glaciers, and heavily forested lower foothills.

Different sections of this report use metric and English units in different ways. All sections written solely by the U.S. Bureau of Mines authors use English units only. All sections written solely by the U.S. Geological Survey authors and those written jointly use metric units with English units following in parentheses.

Access, use, and general character

The study area (fig. 1) is about 72 km (45 miles) southeast of Juneau, the State Capitol, but it is nevertheless remote from regular transportation and communication facilities. Routes of scheduled ferry and aircraft service pass close on the southwest, but access to the area requires chartered or other float-equipped fixed-wing aircraft, helicopter, or vessel. There are no roads and no maintained trails in the study area.

Storms are common throughout the year and the field season months of May through September are characterized by generally decreasing snow cover and generally increasing rain- and snowstorm activity.

There are no permanent communities within the area. Temporary residents are sometimes present during the summer months in Windham Bay and at the mouth of Libby Creek southwest of the study area. There is a permanent residence on Entrance Island in Hobart Bay, also southwest of the area. A permanently staffed camp, which includes buildings, airstrip, telephone service to Juneau, small boat dock, and access roads, supports the Alaska State Power Administration hydroelectric plant at the head of Speel Arm, close to and west of the area.

The rugged terrain makes foot travel slow to virtually impossible in the higher parts of the area and dense forest hinders foot travel in the foothills. The two large rivers that transect the area--the Speel and the Whiting--are suitable for travel by riverboat although it is not known if the rapids 13 km (8 miles) above the mouth of the Speel have ever been run. Those rivers, as well as many other much smaller streams in the area, are difficult or impossible to cross safely on foot.

At the present time the only human activities in the study area are temporary and are either recreational, related to mineral-resource exploration, or to commercial fishing. It is estimated that a few thousand visitors view some part of the area every year from aircraft, ship, or boat; a few ten's come to hunt goats or other wildlife; and a similar small number visit for mineral-resource-related purposes. Old patented mining properties at Windham Bay were recently sold for taxes and acquired by individuals who may intend to develop recreational homesites.

The Tracy Arm-Fords Terror area as a whole is very scenic. It contains heavily forested low mountains, high barren peaks and glaciers, almost-vertical fiord walls, tidewater glaciers in deep valleys, icebergs, and two broad braided rivers.

Figures 2, 3, and 4 near here.

Figure 2.--Oblique aerial photograph looking east across Sumdum Glacier.

Figure 3.

Figure 3.--Oblique aerial photograph looking east towards the head of Tracy Arm.

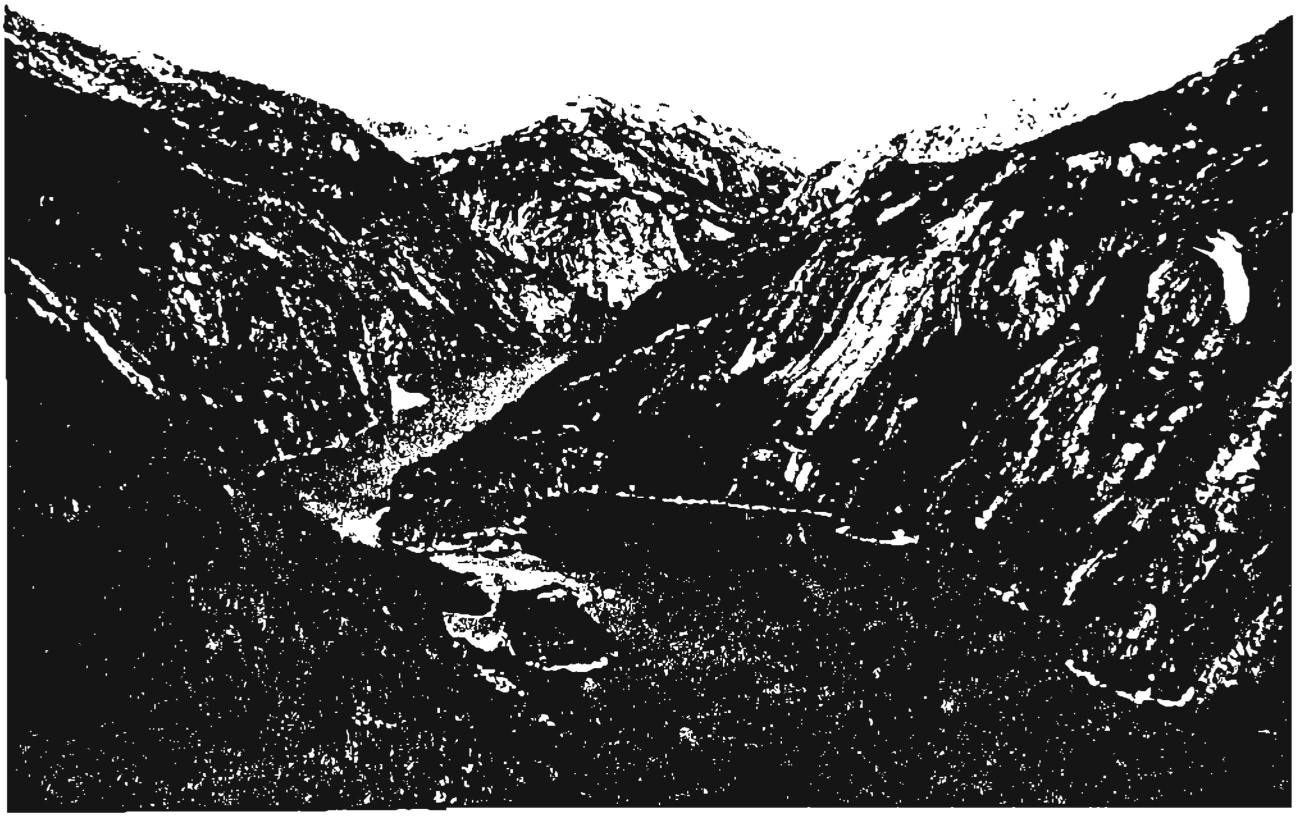


Figure 4.

Figure 4.--Oblique aerial photograph looking north at the Narrows in Fords Terror.

In terms of actual relief, the maximum in the area is between the unnamed 2,470-m peak rising from the South Sawyer Glacier Névé and tidewater at the terminus of the Dawes Glacier, about 12.9 km (8 miles) distant; high local relief is present near the head of Fords Terror where a peak at 1,835 m (6,020 feet) occurs within 3.2 km (2 miles) of tidewater and at the head of Tracy Arm, where only 3.6 km (2.25 miles) separate tidewater at the Sawyer Glacier terminus from an unnamed peak with an elevation ca 2,150 m (between 7,000 and 7,100 feet).

Previous studies

Little was known of the regional geology of the study area prior to the present investigation. Reconnaissance and more specific geologic information provided by Spencer (1906), Buddington and Chapin (1929), Kerr (1931), Gault and Fellows (1953), Souther (1959, 1960, 1971), Miller (1962), Herreid (1962a, b), and MacKevett and Blake (1964) has been the basis for regional geologic compilations prepared by Brew, Loney, and Muffler (1966); Souther, Brew, and Okulitch (1974); and Beikman (1975). The only published geophysical information covering the area is the gravity study reported by Barnes (1972a, b, c, d); Barnes, Olson, and others (1972); and Barnes, Popenoe, and others (1972).

Investigations of glacier-dammed lakes and outburst floods in the area were reported on by Post and Mayo (1971).

General discussions of mineral-resource potential in this part of southeastern Alaska are given by Buddington and Chapin (1929), Ney (1966), Harris (1968), U.S. Geological Survey (1969), and Clark and others (1972); summary mineral occurrence information is given by Cobb and Kachadoorian (1961), Berg and Cobb (1967), Wolff and Heiner (1971), and Cobb (1972a, b). Published geochemical investigations within the area studied are almost all local (Race, 1962; Herreid, 1962a, b: Herbert and Race, 1964, 1965; Clark and others, 1970a, b, c, d).

Reports of specific investigations of mines, prospects, or other metallic or nonmetallic mineral occurrences in the area are found in a variety of reports from different sources going back to the beginning of this century. All of these reports are cited where appropriate in the present report; the principal early studies are reported by Spencer (1906), Wright and Wright (1906), Wright (1907), Buddington (1923, 1952), and Buddington and Chapin (1929). Detailed mapping of the Tracy Arm zinc-copper prospect (also variously known as Neglected Prize, Jingle Jangle and Tracy group) conducted in 1944 under the World War II "strategic minerals program" resulted in the first published detailed work on a specific property (Gault and Fellows, 1953). That prospect had been visited and studied by J. C. Roehm of the Territorial Department of Mines in 1942; by N. M. Muir, U.S. Bureau of Mines, in 1943; and by J. C. Reed and W. S. Twenhofel in 1943. Discovery of the Sumdum copper-zinc deposit in 1958 and ensuing private exploration in 1958 and 1959 resulted in an unpublished report by R. H. Seraphim in 1959 and the later studies by MacKevett and Blake (1964).

Other early work on specific properties included several examinations and reports. The Dittman or Idaho prospect (later known as the 40 percent and Sulphide) was examined by an Alaska-Juneau Gold Mining Company engineer in 1928, and reported on by Kloss (1940-1941).

A prospectus-type report on the Point Astley prospect was written by Ahrenstedt (1928). The lodes on upper Spruce Creek were examined in 1915 by Thane of the Alaska-Gastineau Mining Company, and a report on the Windham Bay Gold Mining Company lodes (Marty Mines) was prepared by Carl Willis (1926). The same properties were examined in 1938 by Joe Williams of the Alaska-Juneau Gold Mining Company.

Further property examination and broader resource investigation were conducted at various times between 1950 and 1969 (Alaska Dept. of Mines, 1950; Thorne and Wells, 1956; Herreid, 1962a; Clark and others, 1970c).

Present investigation

With the exceptions of the 1972 and part of the 1973 seasons when the U.S. Bureau of Mines party was in the field alone, the field operations were conducted jointly from the U.S.G.S. R/V DON J. MILLER II using small boats and cooperatively shared contract helicopter support. The details of the Geological Survey and Bureau of Mines field programs are given below.

Investigations by the Geological Survey included review of previous studies prior to fieldwork. D. A. Brew, Donald Grybeck, A. B. Ford, and Béla Csejtey were assisted in the field by W. S. Lingley, S. W. Nelson, P. A. Frame, and E. A. Rodrigues in August, 1973. D. A. Brew, Donald Grybeck, A. B. Ford, W. R. Vennum, C. J. Nutt and Christine Carlson composed the field party in July and August, 1974, and C. L. Forn participated in stream-sediment and rock-geochemical sampling during part of July. D. A. Brew, Donald Grybeck, A. B. Ford, C. J. Nutt, Christine Carlson, and B. R. Johnson completed the field studies in late June and July of 1975. A total of 51 person-months were spent in the field.

The Geological Survey fieldwork had four main components: reconnaissance geologic mapping; reconnaissance rock-geochemical sampling; stream-sediment sampling; and determination of important geologic relations by visits to some of the mines, prospects, and metallic mineral occurrences assessed in detail by the U.S. Bureau of Mines.

The reconnaissance geologic mapping was carried out on foot, from helicopter, and from outboard-powered skiffs. All shorelines were traversed slowly by parties of two in skiffs, almost all ridges above timberline and suitable for walking were traversed by individuals or parties of two, and all other areas were mapped with spot landings by helicopter at an approximate 1.6 km (1-mile) spacing using one to three persons and a variety of "leap-frog" techniques. The geologic map accompanying this report (pl. 1) results almost entirely from these efforts; a few stations and traverses in the southernmost part of the area were incorporated from unpublished mapping done in 1969 by D. A. Brew, Donald Grybeck, R. J. Wehr, and A. L. Clark.

The reconnaissance rock geochemical sampling program was done in conjunction with the reconnaissance geologic mapping; it involved systematic sampling of common rock types at each station, as well as of all visibly mineralized rocks and altered rocks that might be associated with mineralization. Some of the geochemical anomalies detected were resampled by U.S. Bureau of Mines parties as part of their follow-up program.

Stream-sediment samples were collected from all flowing streams, including a few which disappear beneath major glaciers; some of the anomalies detected were resampled by U.S. Bureau of Mines parties. Geologic relations at some of the more important areas studied in detail by U.S. Bureau of Mines parties were examined during joint visits.

In addition to the above fieldwork, special sampling programs were carried out in two areas in 1974 to test the reproducibility of patterns of elemental variation in stream sediments and rocks, respectively. The results of the stream-sediment sampling experiment are reported by Johnson and others (1977).

The present investigation utilized an aeromagnetic survey done specifically for this study by Geometrics. Inc., under contract to the U.S. Geological Survey. The results of the Survey are included and interpreted in this report.

The Bureau of Mines made field investigations during four field seasons (1972-1975) of all mines, prospects and mining claims which could be found in the study area. In addition, stained or altered zones and geochemically anomalous sites identified during this study were investigated. Evaluation of the above included systematically cutting measured quantitative samples, collecting petrographic specimens, preparing engineering and geologic maps, and gathering other pertinent data.

In addition to the time based on the DON J. MILLER II, fieldwork was conducted from beach tent camps by foot and by outboard-powered skiff during August, 1972, and June, 1973, and follow-up work was conducted from a ridge camp in mid-September, 1975.

The Bureau of Mines investigations were conducted by T. L. Pittman and A. L. Kimball, assisted by R. E. Doler and F. R. Smith during 1972, and by D. D. Keill and F. R. Smith during 1973. A. L. Kimball and J. C. Still were assisted by F. R. Smith, M. A. Parke, K. R. Weir, and W. L. Gnagy during 1974, and by J. L. Rataj, A. H. Clough, K. R. Weir, and W. L. Gnagy during 1975. A total of 22 person-months were spent on field studies.

Analytical support

The samples collected by the Geological Survey and the Bureau of Mines during the field investigations were of four main types: stream sediment geochemical, bedrock geochemical, petrographic, and quantitative. The geochemical samples were used primarily to determine the relative abundance of metallic and other elements in specific rock units; the petrographic samples to determine mineralogy, rock type, and genesis; the quantitative samples to determine grade.

All geochemical samples were analyzed spectrographically for 30 elements by the standard U.S. Geological Survey semiquantitative technique; for gold, lead, zinc, and copper by atomic absorption spectroscopy; and for mercury by the mercury vapor detection technique. Some quantitative samples collected by the Bureau of Mines were fire assayed and some were subjected to special iron assays. Most geochemical samples were routinely scanned for radioactive elements with a scintillation counter in the field. Because of the uncertainty of the scintillation counter under certain conditions, 243 Geological Survey samples chosen at random and several Bureau of Mines samples were analyzed for uranium and thorium by delayed neutron activation analysis. The sensitivity for each element using the various techniques is included in the appropriate tables. Altogether, more than 7,000 samples were processed, analyzed, and interpreted.

The accuracy and precision of the sampling-sample preparation-analysis process cannot be described in a simple statement and the different parts of the process differ for geochemical samples and for quantitative samples. Concerning the analytical part of the process, the accuracy, if not precision, of atomic-absorption spectroscopy, neutron activation analysis, and fire assay is such that errors are inconsequential compared with the problem of obtaining chemically homogeneous replicate samples at the same sample site. The spectrographic analyses are subject to more variability. The values are presented by giving the nearest midpoint in a six-step series that uses 1, 1.5, 2, 3, 5, 7, 10...as the midpoints of the intervals. In a comprehensive study of the precision of the spectrographic method Motooka and Grimes (1976) showed deviations in replicate analyses of up to two intervals away from the preferred value. Samples that were rerun during the course of this study rarely deviated more than one interval from the previous value and by far the majority gave the same value upon reanalysis. In addition, a systematic program of field resampling at selected localities and comparison of those analyses with the previous values seldom showed deviations of more than one interval.

Concerning the sampling and sample preparation parts of the process, measured cut quantitative samples are probably less susceptible to site variability than are grab-type geochemical samples but the reproducibility of analytical results for different splits of the same sample is greatly influenced by the care exercised in sample preparation. Careful preparation of a sample is as important as the analysis itself. The quantitative samples also do not lend themselves well to statistical analysis because of the emphasis on individual samples or small groups of samples from a given location.

Metal values are reported in parts per million (ppm) throughout this report, except for spectrographic analyses of Fe, Mg, Ca, and Ti, which are reported in percent. Where especially high values are discussed in the text, the values in ppm may be followed with percent in parentheses (%); gold and silver, however, are expressed in troy ounces per ton. Table 1 provides conversion between ppm, percent, and ounces per ton.

TABLE 1 NEAR HERE.

Table 1.--Conversion of parts per million to percent and to troy ounces per ton and vice versa

[Conversion factors: 1 lb avoirdupois = 14,583 ounces troy; 1 ppm = 0.0001 percent = 0.0291667 ounce troy per short ton = 1 gram per metric ton; 1 ounce per ton (Au or Ag) = 34.286 ppm = 0.0034286 percent]

Parts per million to percent to ounces per ton			Ounces per ton to percent to parts per million		
Ppm	Percent	Ounces per ton	Ounces per ton	Percent	Ppm
0.01	0.000001	0.0003	0.01	0.00003	0.3
.02	.000002	.0006	.02	.00007	.7
.05	.000005	.0015	.05	.00017	1.7
.10	.00001	.003	.10	.00034	3.4
.20	.00002	.006	.20	.00069	6.9
.30	.00003	.009	.30	.00103	10.3
.40	.00004	.012	.40	.00137	13.7
.50	.00005	.015	.50	.00171	17.1
.60	.00006	.017	.60	.00206	20.6
.70	.00007	.020	.70	.00240	24.0
.80	.00008	.023	.80	.00274	27.4
.90	.00009	.026	.90	.00309	30.9
1.0	.0001	.029	1.0	.00343	34.3
10.0	.001	.292	10.0	.03429	342.9
20.0	.002	.583	20.0	.06857	685.7
50.0	.005	1.458	50.0	.17143	1,714.0
100.0	.01	2.917	100.0	.34286	3,429.0
500.0	.05	14.583	500.0	1.71	17,143.0
1,000.0	.10	29.167	1,000.0	3.43	34,286.0
10,000.0	1.00	291.667	10,000.0	34.29	342,857.0

All Bureau of Mines and Geological Survey geochemical samples were prepared and analyzed in the Geological Survey Branch of Exploration Research Field Services Section mobile laboratory in Anchorage, Alaska, and in that organization's Golden, Colorado, laboratory during and following the 1973 and 1974 field seasons. Analysts in 1973 were R. W. Leinz, R. B. Carten, D. Siems, and J. Abrams and sample preparation was done largely by T. Horkan. Analysts in 1974 were C. L. Forn and J. C. Hoffman and preparation was by S. Quintana. In 1975, all 1975 season samples and Bureau of Mines 1972 samples were processed at a Geological Survey mobile laboratory located at the Bureau of Mines facility in Juneau, Alaska. Analysts were again Forn and Hoffman; Geological Survey sample preparation was by P. R. Johnson and Bureau of Mines preparation by G. Mills.

Duplicate atomic absorption determinations were made in the Bureau of Mines laboratory, Reno, Nevada, under the direction of H. H. Heady on a group of Bureau of Mines ore samples with especially high base-metal content. Fire assays were run in Juneau by C. W. Merrill, Jr., on Bureau of Mines samples where gold or silver were of special interest, and on panned concentrates. Merrill also made Davis tube separations on iron samples which were then analyzed at the Reno Bureau of Mines laboratory.

Bureau of Mines petrographic studies were conducted by Walter Gnagy with intermittent assistance from Mary Ann Parke. Geological Survey petrographic studies were by the Survey authors, assisted by T. T. Redman and J. K. Cannon.

Acknowledgments

Most of the field operations were based on the U.S. Geological Survey R/V DON J. MILLER II and the support efforts of the crew: R. D. Stacey, Master; E. C. Magalhaes, Engineer; and E. M. Kuehn, Cook-Seaman contributed to the timely and efficient operation of the project. Geological Survey manipulation of the geochemical data was greatly facilitated by the efforts of S. K. McDanal and R. J. Smith, computer specialists, Golden, Colorado. The skill, judgment, and interest of the helicopter pilots: J. Pellet, 1973; S. H. Dillman, 1974; and C. H. Molvig, 1975, contributed greatly to the operation. Some information on the active claims near Sumdum Glacier was provided by Cities Service Minerals Corporation and general information on mining activity and on the history of the Windham Bay mining district was provided by Herman Kloss, a nearby resident.

Geology

By

David A. Brew and Donald Grybeck

Geologic setting

The Tracy Arm-Fords Terror Wilderness Study Area spans the Coast Range batholithic complex and adjacent rocks in southeastern Alaska. The complex is a large geologic feature of the earth's crust extending almost unbroken for about 1,770 km (1,100 miles) from near the British Columbia-Washington boundary at the 49th parallel on the south to the Yukon Territory-Alaska boundary at longitude 141° W. on the north and ranging in width from about 100 km (60 miles) to 200 km (120 miles).

Throughout British Columbia and southeastern Alaska the Coast Range batholithic complex and the adjacent rocks can be subdivided into four parallel zones; from southwest to northeast they consist of 1) low- to high-grade regional metamorphic rocks with a few epizonal to mesozonal granitic bodies, 2) high-grade metamorphic rocks with some mesozonal granitic intrusive bodies, 3) mesozonal to epizonal granitic intrusive rocks with screens and pendants of high-grade metamorphic rocks, and 4) high- to low-grade contact metamorphic rocks. In general the metamorphic rocks are of original Late Paleozoic or Early Mesozoic age, with some of Middle or Late Mesozoic age probably also present, and the granitic rocks are Middle Mesozoic to middle Cenozoic in age. These regional zones are shown diagrammatically in figure 5.

Figure 5 near here.

Figure 5.-- Relations of regional and local geologic zones, map units, and mineralized belts and favorable areas, Tracy Arm - Fords Terror Wilderness Study Area, Alaska

	SW ← (1)	(2)	(3)	(4) → NE
Regional geologic zones	Low- to intermediate temperature, intermediate to high pressure facies series metamorphic rocks with some mesozonal granitic bodies	Intermediate temperature, intermediate to high pressure facies series metamorphic rocks with some mesozonal granitic bodies	Mesozonal to epizonal granitic intrusives with screens and pendants of metamorphic rocks as to SW.	Low to high temperature, low to intermediate pressure facies series rocks with some epizonal granitic bodies
Local geologic zones or sub-zones in Tracy Arm - Fords Terror area	"Western metamorphic belt" (1) (2) (3) Low grade (prehnite-pumpellyite metagraywacke to greenschist facies) metadetrital and volcanic rocks with granitic intrusions (4) High-grade (amphibolite facies) metamorphic rocks	"Coast Range batholithic complex" (5) Remarkably long foliated quartz diorite "Speel River - Fords Terror sill" (6) Broad terrane of gneiss, schist, and marble	(7) Granodiorite, granite, and associated migmatite of inferred Tertiary age along International Boundary	Not present on U.S. side of International Boundary
Map units shown on Plate 1 and described in text	← Greenschist and greenstone → ← Phyllite and slate → ← Limestone → Hornblende schist and amphibolite ↔ Biotite schist ↔ Marble and calc-silicate schist ↔ → ← Ultramafic rocks of Cretaceous(?) age → ← Porphyritic garnet-biotite-hornblende diorite → ← Gneiss domes of Tertiary or Cretaceous age →	← Gneiss and schist of Coast Range batholithic complex → ← Foliated biotite-hornblende tonalite → ← Granitic rocks of Tertiary age and associated migmatites →		
Mineralized belts and favorable areas	← "Endicott Peninsula Area" → ← "Sumdum Glacier Mineral Belt" →			

Figure 5.--Relations of regional and local geologic zones, belts, map units, mineralized belts and favorable areas, Tracy Arm-Fords Terror Wilderness Study Area, Alaska.

These four zones are subdivided into seven irregular sub-zones in the Tracy Arm-Fords Terror Wilderness Study Area (fig. 1). The southwestern four of the sub-zones are referred to together in this report as the "western metamorphic belt" and correspond to the southwesternmost main zone described above. The southwesternmost three of these same sub-zones consist of low-grade metamorphosed detrital and volcanic rocks of probable Late Paleozoic or Early Mesozoic age cut by complicated granite, diorite, and hornblendite intrusions with locally extensive contact metamorphic effects. The fourth sub-zone consists of higher grade metamorphic rocks; the original ages of the rocks are uncertain, but they are probably also Late Paleozoic or Early Mesozoic.

The next two sub-zones correspond to the second main zone described above and consist of a remarkably long foliated tonalite sill of inferred Late Mesozoic age, referred to sometimes as the "Speel River-Fords Terror sill" in this report, and a broad terrane of gneiss, schist, and marble of uncertain original age. The next sub-zone consists of granite and granodiorite bodies of inferred mid-Tertiary age along the International Boundary and is the same as the third main belt. The foliated tonalite sill; the broad gneiss, schist, and marble terrane; and the zone of discontinuous granitic bodies are referred to together as the "Coast Range batholithic complex" in this report.[1/]

[1/] The term "Coast Range batholithic complex" as used here is not synonomous with the Canadian terms "Coast complex" or "Coast plutonic complex" because those terms include all adjacent metamorphic rocks.

The northeasternmost of the four main zones is not present in the Tracy Arm-Fords Terror Wilderness Study Area, as it lies to the east of the International Boundary. The relations of these regional and local zones and subzones are shown in figure 5.

The southwestern four sub-zones, that is, the western metamorphic belt, are part of the Wrangell-Revillagigedo metamorphic belt of Buddington and Chapin (1929) and also include part of the Juneau Gold Belt of Spencer (1906).

The general lack of information about the original age of the rocks in the study area and the complexity of the metamorphic and intrusive history make conventional description of map units and structure difficult and cumbersome. The descriptions provided here for the different map units are therefore organized loosely according to 1) zone or sub-zone, 2) lithic type, and 3) age; with different factors emphasized for different units. Distribution of the map units is shown on plate 1 and the names of these units are given at the appropriate place in the descriptions below and shown in relation to regional zones, and local sub-zones in figure 5. It should be noted that all of the non-intrusive map units are metamorphic-rock units and more than one such unit may be derived from the same original unit. The suggested correlations provide a means of reconstructing the present extent of original units.

Map units

Low-grade metamorphic rocks of western metamorphic belt

The western metamorphic belt in the study area consists of a low-grade part, the units of which are described here, and a high-grade part to the east. This geographic distinction is blurred by the occurrence of high-grade units near intrusives within the low-grade belt.

Greenschist and greenstone

The greenschist and greenstone map unit (Kmgs) occurs in a 61-km- (38-mile-) long, 8-km- (5-mile-) wide, irregularly shaped belt running from the study area boundary on the Snettisham Peninsula southeastward through the Endicott Peninsula to the boundary west-southwest of the head of Endicott Arm (pl. 1). It surrounds large and small outcrop areas mapped as the phyllite and slate unit and as the limestone unit. Locally, appreciable quartzite is interlayered with the dominant greenschist and greenstone.

The rocks are mostly greenschist metamorphic facies, but to the southeast the unit includes rocks of transitional greenschist-amphibolite facies and of the amphibolite facies. There the unit grades into the hornblende schist and amphibolite map unit.

The main rock types in the lower grade part of the unit are light- to medium-green rarely dark-green, fine- to medium-grained chlorite phyllite, semischist, greenstone, greenschist, and mica schist. Minor marble, metadiabase, and quartzite are present. The main rock types in the higher grade part of the unit are amphibolite, and biotite and hornblende schist and gneiss.

In more detail, the rocks of the lower grade part are, in order of decreasing abundance (and using the conventions of showing the minerals of each assemblage in order of increasing abundance and of showing those which may or may not be present in parentheses): chlorite-quartz phyllite and semischist, (hornblende)-quartz-chlorite-(plagioclase) phyllite and greenschist, (epidote)-plagioclase-chlorite greenstone and greenschist, chlorite schist, biotite-chlorite-(quartz)-plagioclase greenschist; (quartz)-mica phyllite, graphite phyllite, muscovite-(feldspar)-quartz schist and semischist, (mica)-quartz quartzite, biotite-(epidote)-hornblende-(plagioclase) greenschist, amphibole-mica-plagioclase schist, plagioclase-actinolite-(quartz)-(chlorite) greenschist and semischist, calcite-graphite marble, chlorite-feldspar metadiabase, chlorite-calcite schist, and actinolite-graphite quartzite.

Similarly, the rocks of the higher grade parts are: (feldspar)-hornblende amphibolite, biotite schist, actinolite schist, hornblende schist, (biotite)-hornblende gneiss, garnet-(chlorite)-(plagioclase)-hornblende gneiss, and biotite-quartz-feldspar gneiss.

This unit appears to be derived from an original assemblage of volcanic rocks, carbonaceous shale, limestone, and chert. The latter three lithic types are now the dark-gray graphite phyllite, marble, and quartzite. The original nature and composition of the volcanics is uncertain; some of the greenstones and semischists probably were diabase intrusions; some may have been massive flows. At a few localities the greenstones and greenschists contain relict pyroxene phenocrysts, but this is not typical of the unit. Some of the greenschists and green phyllites contain common to widely scattered ellipsoids to 20 cm maximum dimension of poorly foliated greenstone; these may be either tectonically transposed and disrupted original layers of contrasting lithology or tectonically shaped lithically different original clasts. If the latter interpretation is correct, then a significant part of the original volcanic section is inferred to have been coarsely fragmental. There are no chemical compositional data available for these rocks at this time.

The original age of the greenschist and greenstone unit is not known directly, but is inferred to be Triassic(?) and Permian(?) because of 1) the fossil evidence for a Permian(?) age of the intercalated limestone map unit on the Snettisham Peninsula, and 2) fossil evidence from the Juneau area 64 km (40 miles) to the northwest for a Late Triassic age of dark-gray carbonaceous phyllites and shales like those of the locally intercalated phyllite and slate map unit. The age of metamorphism, as discussed in the structure section of this report, is inferred to be Late Cretaceous.

The rocks of this map unit are similar in original lithology and(or) age to rocks to the northwest, west, and southwest. They can be mapped along strike into unnamed units in the Taku Harbor and Juneau areas (Ford and Brew, 1977; Brew and Ford, 1977) and beyond to the northwest; they are not recognized to the southeast along strike into the Port Houghton area. Triassic and Permian rocks are known on Admiralty Island, about 32 km (20 miles) across regional strike to the west and southwest (Lathram and others, 1965; Loney, 1964). There at least 910 m (3,000 feet) of graywacke, argillite, chert, phyllite, conglomerate, altered pillow lavas and breccias, and overlying dolomite of Early Permian age are present; these rocks are overlain unconformably by an indeterminate thickness (probably greater than 790 m (2,600 feet) maximum) of thin-bedded impure limestone, black chert, and black slate interfingering with and overlain by basalt and andesite pillow flows of Late Triassic age. An undifferentiated Permian and Triassic rock unit on Admiralty Island consists of schist, graywacke semischist, conglomerate, phyllite, schistose volcanic flow breccia, andesite flows and tuffs, marble, and chert (Lathram and others, 1965). Correlative strata are also present in the Keku Strait area due south of these Admiralty Island localities (Muffler, 1967).

The greenschist and greenstone map unit underlies most of the Endicott Peninsula and the Point Astley, Sumdum Chief, Sulphide, Holkam Bay, and Spruce Creek claims and prospects are all located within it. It is thus the host for a significant number of the known deposits in the study area. At many of these localities the rocks are bleached or otherwise altered. The unit also contains relatively high background amounts of several metallic elements, as discussed in the section on geochemistry.

Phyllite and slate

The phyllite and slate unit (Kmps) occurs on the Endicott Peninsula largely as very large lenses within and adjacent to the greenschist and greenstone unit (pl. 1). West and southwest of Windham Bay the phyllite and slate unit extends beyond the study area boundary and underlies most of the area next to Stephens Passage. The unit also occurs on the northeast side of Holkam Bay and Endicott Arm along the shore from the mouth of Tracy Arm southeast almost to the mouth of Fords Terror.

The unit is mostly greenschist metamorphic facies, but may be prehnite-pumpellyite-metagraywacke facies in part, particularly in the southwesternmost exposures. The unit is amphibolite facies locally to the southeast and in the outcrop area northeast of Endicott Arm and grades into the biotite schist map unit with increasing metamorphic grade.

The main rock types in the unit are black and light-green phyllite with some slate, quartzite, and greenschist; most are fine- to very fine-grained. These rocks are derived from dominantly fine-grained detrital sediments together with fine-grained volcanic sediments or tuffs and minor limestone.

In more detail, and using the conventions introduced in the previous section, the common rock types are graphite-(quartz)-(mica) phyllite, chlorite-quartz-(muscovite) phyllite, quartz-calcite phyllite, chlorite-(quartz)-(plagioclase) greenschist, mica slate, (biotite)-(amphibole)-quartz quartzite, biotite-(chlorite)-(plagioclase)-(muscovite) phyllite, biotite-(quartz)-(garnet)-(muscovite) schist and semischist, (biotite)-chlorite-(muscovite)-(quartz) schist and greenschist, amphibole-(plagioclase)-(chlorite)-(biotite) schist, amphibole-chlorite-(plagioclase) greenstone, mica-calcite calc-silicate rock, and (graphite)-(tremolite)-calcite marble.

The original age of the phyllite and slate map unit is not known directly, but it is inferred to be Triassic(?) and Permian(?) on the basis of the evidence discussed above for the greenstone and greenschist map unit. As noted below, it is possible that some of the southwesternmost outcrops are of Jura-Cretaceous age, but no paleontologic evidence exists. As discussed in the structure section, the age of metamorphism is inferred to be Late Cretaceous.

Rocks of this map unit are similar in original lithology and(or) age to unnamed units in the Taku Harbor and Juneau areas (Ford and Brew, 1977; Brew and Ford, 1977) and correlative rocks are known on Admiralty Island to the southwest, as discussed for the greenstone and greenschist map unit. Some 1,500 m (5,000 feet) of strata assigned to the Seymour Canal Formation of Late Jurassic and Early Cretaceous age, which consists of slate, graywacke, and conglomerate also occur on Admiralty Island. Rocks which correlate lithically with the Seymour Canal Formation occur at Point Fanshaw on the mainland side of Stephens Passage about 65 km (40 miles) south of the study area. Those same strata may extend northward across the mouth of Port Houghton to the vicinity of Hobart Bay, where they join the mapped extension of the phyllite and slate map unit.

No significant metallic mineral deposits are known to exist in this map unit within the study area. In the Juneau area, however, a lithically correlative phyllite and slate unit is the main host rock for the large, low-grade Alaska-Juneau gold deposit (Ford and Brew, 1973; Brew and Ford, 1974).

Limestone

The limestone map unit (Kmls) occurs interlayered with the greenstone and greenschist map unit on the Snettisham Peninsula and the northern end of the Endicott Peninsula (pl. 1). The rocks of the unit are recrystallized but have in general retained the original appearance of limestone in spite of greenschist facies metamorphism. Some massive marble is present locally. Most of the unit is medium- to light-gray, very thin to very thick bedded, fine- to coarse-grained marble with abundant interlayers of dark-gray or black graphitic slate and phyllite. Other rock types present are mica phyllite, chlorite semischist and greenstone, and calcite-graphite shale. Karst topography is common on the broader outcrop areas.

The age of the limestone map unit is Permian(?), based on a fossil collection from the Snettisham Peninsula, which was reported on as follows (J. T. Dutro, written commun., 1973):

"Colln. 3C-425A (USGS M1125-PC). Alaska, Southeastern, Sumdum D-6 quad., sec. 2, T. 47 S., R. 72 E.; just below and west of unnamed peak of elevation 2583 ft. above sea level, 4 miles ESE of Midway Island in Stephens Passage, approx. 45 mi. SE of Juneau, north of the entrance of Tracy Arm, Holkham Bay.

Collector: Béla Csejtey, 1973.

The brachiopod in this collection is recrystallized so that shell ornament is not preserved. However, the specimen is certainly a large productid and indicates Carboniferous or Permian age. The size and shape of the fossil are much like the better-preserved specimens, collected by Kindle from Stockade Point on Taku Harbor that Girty identified as PRODUCTUS aff. P. GRUENEWALDTI. This form is found elsewhere in the Permian of southwestern [sic]/Alaska (see Buddington and Chapin, 1929, p. 73, 128, 129). A collection I made at Taku Harbor in 1957 contained probable SPIRIFERELLA and MEGOUSIA and is thus most likely Permian. Similar fossils were found at Windfall Harbor and Gambier Bay, on the east side of Admiralty Island, where the Permian is directly overlain by Triassic strata. Upper Triassic dark slates with MONOTIS? were collected by me on upper Sheep Creek, south of Juneau, in 1957. It seems most probable that rocks of both Permian and Triassic age are included in the metamorphosed sediments along the west edge of the metamorphic complex between Juneau and Holkham Bay. I suggest that the marbles of Taku Harbor and Holkham Bay be considered Permian(?) in age".

The collections from Taku Harbor referred to above occur in marble or limestone interlayered with phyllite, mica schist, chert, and black graphitic slate, schistose greenstone. There were also fossils collected from the northwest side of the Snettisham Peninsula (Buddington and Chapin, 1929, p. 73):

"Fossils identified by Girty as Carboniferous (lot 5138: Batostomella? sp., Stenopora? sp., and Spirifer? sp.) were collected by Buddington from schistose limestone associated with greenstone on the shore of the Snettisham Peninsula northeast of the Midway Islands. Carboniferous fossils (Productus aff. P. gruenewaldti) had previously been reported by Kindle from Stockade Point, on Taku Harbor".

The other localities in the general area noted by Buddington and Chapin (1929, p. 119) as fossiliferous were not recovered. However, a collection from a new locality on the north end of the Endicott Peninsula was reported on as follows (A. K. Armstrong, written commun., 1973):

"Field No. 3HO14B (Upper Paleozoic loc. 1122). 57 degrees, 42 min 30 sec. N., long 133 degrees 35 min 40 sec N, T. 48 S., R. 73 E.

Collector: H. C. Berg, 1973.

The rock is a recrystallized arenaceous-bryozoan-crinoid wackestone (limestone). The lime mud matrix is now 50 to 150 micron-size calcite crystals. The bryozoan zoaria have also been recrystallized as have the lime mud fillings in the zooecium. Other fossil fragments seen are brachiopod, echinoderm, and hollow tubes, which may be productid spines. Subrounded grains of quartz 0.1 to 0.3 mm in size are present. The rock contains numerous styolites and large fractures filled with calcite.

The strong recrystallization has obliterated all microfossils, but relic textures strongly suggest this is a Paleozoic rock."

These limestones are an integral part of the assemblage of rocks that make up the low-grade part of the western metamorphic belt and their correlation across strike to Admiralty Island is covered in the discussion of the greenstone and greenschist unit. No limestones have been recognized in the study area south of Windham Bay (pl. 1) or in the Port Houghton area to the south (D. A. Brew and D. Grybeck, unpub. data). To the north of the study area are the limestones on the Snettisham Peninsula, at Taku Harbor, and in the Juneau area (Ford and Brew, 1973; Brew and Ford, 1977).

High-grade rocks of the western metamorphic belt

The western metamorphic belt adjacent to the Speel River-Fords Terror sill consists of two main rock units, the biotite schist unit (Kmsb) and the hornblende schist and amphibolite unit (Kmsh), and a minor unit, the marble and calc-silicate schist unit (Kmmb) which is also a map unit within the batholithic complex.

Hornblende schist and amphibolite

The hornblende schist and amphibolite (Kmsh) unit is exposed continuously for about 65 km (40 miles) parallel to the Speel River-Fords Terror sill, in an elongate area on the opposite side of Endicott Arm near its head, and in three isolated areas near Windham Bay (pl. 1).

The unit is characterized by fine- to medium-grained, medium- to dark-green, well-foliated hornblende schist and gneiss, but it also includes significant amounts of biotite gneiss, quartzite, biotite-hornblende gneiss, and poorly foliated amphibolite. All are amphibolite metamorphic facies. In more detail, and using the conventions noted earlier, the rock types in the unit include: hornblende-(biotite)-plagioclase-(chlorite)-(quartz) schist, hornblende-(garnet)-(biotite)-plagioclase-(quartz) gneiss, (garnet)-biotite-quartz-(muscovite)-(plagioclase) schist, hornblende-(plagioclase) amphibolite, (quartz)-muscovite-chlorite-(biotite) schist, (biotite)-quartz-(garnet)-(muscovite) quartzite, quartz-chlorite-plagioclase-(hornblende)-(biotite) semischist, (biotite)-(plagioclase)-actinolite (chlorite) schist and semischist, quartz-chlorite-(plagioclase)-(amphibole)-(biotite) greenschist, and calcite-calc-silicate marble.

These rocks were probably derived from a dominantly volcanic section that also included fine-grained detrital rocks, chert, perhaps graywacke, and minor carbonates. These original rock types are similar to those suggested for the greenstone and greenschist map unit (Kmgs) and, indeed, on the Endicott Peninsula the hornblende schist and amphibolite map unit grades laterally into that unit with increasing metamorphic grade. It is likely that this is the situation for all of the hornblende schist and amphibolite map unit and therefore the correlations suggested earlier apply to this unit also.

The northeastern outcrop area of this map unit is the host rock for part of the Sumdum Glacier mineral belt (fig. 1), which is the area of highest mineral potential in the study area.

Biotite schist

The biotite schist map unit (Kmsb) is exposed continuously for 65 km (40 miles) immediately adjacent to the Speel River-Fords Terror foliated quartz diorite sill, in three isolated elongate areas southwest of the head of Endicott Arm, and in one large isolated area north of Windham Bay adjacent to the porphyritic garnet biotite-hornblende diorite intrusions (pl. 1).

The unit in general consists of brown, fine- to medium-grained biotite and hornblende schist with significant amounts of micaceous quartzite. The rocks are amphibolite metamorphic facies, with the gneisses more common closer to the batholithic complex. The petrography of the map unit near the Sumdum Glacier has been described in some detail by MacKevett and Blake (1964).

In more detail, and using the same conventions as before, the rock types present include: biotite-(garnet)-(staurolite)-(sillimanite)-plagioclase-(quartz) schist, hornblende-(biotite)-(plagioclase)-(quartz)-(garnet) schist, mica-(garnet) quartzite, hornblende-(biotite)-(garnet) gneiss, biotite-quartz-(garnet)-(feldspar) gneiss, hornblende-(plagioclase) amphibolite, biotite-(garnet)-(quartz)-(feldspar) semischist, biotite-kyanite-feldspar gneiss, garnet-diopside calc-silicate rock, marble, graphite-biotite schist, (hornblende)-(epidote)-chlorite greenschist, chlorite-quartz-muscovite-plagioclase schist, and biotite-(hornblende)-(garnet)-(graphite)-(quartz) phyllite.

The rocks were probably derived primarily from an original fine- to medium-grained clastic section that contained significant amounts of chert, volcanics, and, locally, thin carbonates. These original rock types are similar to those proposed for the phyllite and slate unit (Kmps) and some of the outcrop areas on the Endicott Peninsula grade into rocks of that map unit. The correlations suggested earlier for that unit apply to the biotite schist map unit also.

The biotite schist map unit includes most of the host rocks for the Sumdum Glacier mineral belt (fig. 1),which is the highest mineral potential area in the study area. As noted above, the unit there has been studied by MacKevett and Blake (1964).

Marble and calc-silicate schist

One small area 2 X .2 km (1.5 X .1 miles) of marble and calc-silicate rock (Kmmb) occurs between the biotite schist and the hornblende schist and amphibolite map units about due east of Sumdum Island (pl. 1). The unit consists of fine- to coarse-grained gray marble, calc-silicate rock and schist, and biotite-quartz-feldspar schist.

High-grade metamorphic rocks of Coast Range batholithic complex

One widespread map unit, here called the gneiss and schist of Coast Range batholithic complex (Kmgn), and a less widespread unit, here called the marble and calc-silicate gneiss of Coast Range batholithic complex (Kmmb), underlie much of the higher part of the Coast Range (pl. 1). Because of the difficulty of access and the extensive glacier cover, these units are not as well understood as the metamorphic rock units southwest of the batholithic complex.

Gneiss and schist of Coast Range batholithic complex

This map unit lies, with the exception of a few small areas within the Speel River-Fords Terror sill and two areas adjacent to the southwest side of that sill, between that sill and the International Boundary (pl. 1). The irregular distribution of the mid-Tertiary granitic rocks and their associated migmatites gives this gneiss and schist map unit a similar irregular distribution, but one main elongate outcrop area does persist for some 80 km (50 miles) along the sill in the southern and central parts of the study area.

In general the map unit consists of fine- to coarse-grained heterogeneous granitic gneiss, migmatite, biotite gneiss, biotite schist, hornblende schist, calc-silicate rock, quartzite, marble, and amphibolite of the amphibolite metamorphic facies. The unit was broken into several map units during field studies; the main ones consisted of dominantly hornblende schist and gneiss, dominantly biotite schist and gneiss, and of granitic gneiss. Locally, all of the different lithic types form the nongranitic phases of migmatites of the stockwork, veined gneiss, irregular banded gneiss, and banded gneiss types; the granitic phases are commonly biotite granodiorite and (garnet)-biotite-hornblende granodiorite and tonalite. Some of the granitic gneisses are relatively homogeneous and may be orthogneisses; others are heterogeneous.

In more detail, and using the previous conventions, the rock types present are: (garnet)-biotite-quartz-feldspar gneiss; hornblende-biotite-quartz-feldspar gneiss; hornblende-(biotite)-(quartz)-(feldspar) gneiss, granitic gneiss, veined gneiss and banded gneiss; (garnet)-biotite-quartz-feldspar schist; hornblende-(biotite)-(quartz)-(garnet)-(plagioclase) schist; biotite-(quartz)-(plagioclase) gneiss and schist; biotite-quartz quartzite; hornblende (plagioclase) amphibolite; biotite-feldspar-garnet-sillimanite-muscovite schist; (epidote)-calcite-calc-silicate gneiss; calc-silicate-calcite marble; garnet-wollastonite-calcite-diopside calc-silicate rock; garnet-diopside-calcite marble; and graphite-calcite marble.

In some areas the biotite-rich schist and gneiss of this map unit are brightly stained by reddish-orange iron oxides. As discussed in the mineral resources section of this report, several of these stained zones were sampled in detail to determine the origin of the iron oxides. It was concluded that most are probably derived from biotite and minor sulfides rather than from high concentrations of iron sulfide minerals.

These rocks are the metamorphic equivalents of a dominantly clastic section, probably both fine and coarse grained, with closely associated originally intermediate or basic rocks, probably volcanics. The quartzites and marbles probably represent original cherts and limestones within the complex section. As just noted, some granitic gneiss units may represent thoroughly deformed and metamorphosed original granitic bodies.

As discussed by MacKevett and Blake (1964), the correlation of any of the rocks within the Coast Range batholithic complex is problematical. They may correlate with some or all of the rocks of the western metamorphic belt discussed previously and thus would be of probable original Permian(?) through Early Cretaceous(?) age. Alternatively, they may correlate with rocks exposed on the Canadian side of the International Boundary that are considered by Souther (1959, 1971) to be of Carboniferous through pre-Late Triassic age. Another alternative is that these rocks are Early and Middle Paleozoic in age; this is based on the observation that the closely associated marble and calc-silicate gneiss map unit (Kmmb) represents a larger proportion of carbonate rocks than is common in the nearby Upper Paleozoic and Lower Mesozoic section and that such a large proportion can be found only within the older Paleozoic section exposed in the Alexander Archipelago (Brew and others, 1966). There is no fossil evidence to support this hypothesis.

There are no significant metallic mineral deposits known to be associated with this map unit.

Marble and calc-silicate gneiss

of Coast Range batholithic complex

The marble and calc-silicate gneiss map unit (Kmmb) is irregularly distributed in the Coast Range batholithic complex, but most of the outcrop areas are concentrated along the northeast side of the Speel River-Fords Terror sill about opposite Holkam Bay, in the general area of the western branch of the North Sawyer glacier, or near the intersection of the Sweetheart Lake lineament and Experiment Creek (pl. 1).

In general the map unit consists of heterogeneous schist, gneiss, calc-silicate rock, and marble of the amphibolite metamorphic facies. Some outcrop areas are almost entirely marble; others contain only thin discontinuous marble layers.

In more detail, and using the same conventions as before, the rock types include: medium- to coarse-grained, gray, (graphite)-calcite marble, (calc-silicate)-(actinolite)-calcite marble, diopside-calcite calc-silicate gneiss, wollastonite-calcite-calc-silicate gneiss, garnet-diopside gneiss, and generally fine- to coarse-grained, locally iron-stained biotite-quartz-(feldspar) schist, biotite-quartz (feldspar)-gneiss, biotite-hornblende-(quartz)-(feldspar) gneiss, (biotite)-(calcite)-calc-silicate schist, quartzite, and garnet-sillimanite-biotite-quartz-plagioclase gneiss.

This map unit appears to be derived from limestone and limy sediments. The present discontinuity of the map unit may be due to original lenticularity of the sediments as well as to later tectonic disruption. As discussed above, the correlation of this unit and the enclosing gneiss and schist unit is problematical.

Although the lithic types in this map unit would appear to be favorable hosts for metallic mineral occurrences because of their composition and proximity to younger granitic bodies, the Whiting River silver-gold prospect is the only known significant occurrence.

Ultramafic rocks of Cretaceous(?) age

Ultramafic rocks of Cretaceous(?) or older age (Kuum) occur as widely scattered pods and small bodies showing no direct field relationship to each other. Different occurrences have been mapped as hornblende pyroxenite, clinopyroxenite, peridotite, and dunite and as undivided ultramafics. Most of the occurrences contain serpentinite as well as other rock types (pl. 1). Almost all of these bodies, the main exception being the body at Windham Bay, occur in a 19-km (12-mile-)-wide north-northwest-trending belt about through the center of the study area.

The many small bodies shown on plate 1 are probably only a fraction of the actual number of bodies present; the ice, snow, precipitous terrain, and small size of individual bodies make their recognition difficult.

The Windham Bay ultramafic body is the best known occurrence of ultramafic rocks in the area. It is generally like the body at Port Snettisham about 50 km to the north. Fine- to very coarse-grained, sulfide-bearing ultramafic rock occurs along the shore west of the mouth of the Chuck River for a distance of approximately two miles. The body is layered in part and consists largely of clinopyroxenite with possible secondary amphibole-rich rock. Locally, several centimeter-sized plates of biotite are common. The body includes screens of possible metasedimentary rocks and some float of coarse-grained marble with ultramafic layers was noted. Contacts, although poorly exposed, appear to be gradational with the enclosing greenschist and greenstone and hornblende schist and amphibolite map units. On the north side of the bay the body consists largely of amphibolite complexly mixed with biotite schist and gneiss.

A small body, less than 30 m (100 feet) in diameter, was mapped approximately 3 km (2 miles) south of the terminus of the Dawes Glacier at the head of Endicott Arm (pl. 1). It is a large inclusion of medium-grained dunite in a zone of abundant mafic inclusions in Eocene(?) hornblende granodiorite.

Hornblende pyroxenite has been mapped in several areas. One is 8 km (5 miles) north of the Dawes Glacier terminus within a unit of heterogeneous granitic gneiss and migmatite. Greén-brown, coarse-grained hornblende pyroxenite and pyroxene-biotite-hornblendite occur as pods and boudins in dark-gray, medium-grained, C.I. 70, feldspar-hornblende gneiss. Six km (4 miles) east-northeast of the eastern lobe of Fords Terror a lozenge-shaped pod of medium-grained, gray-green hornblende pyroxenite is alined parallel to the northwest-striking foliation in biotite gneiss, schist, calc-silicate rock, quartzite and marble.

The greatest concentration of ultramafic bodies in the study area is found between the eastern part of Tracy Arm and the prominent northeast-trending valley parallel to and just south of the Whiting River. The bodies occur within a variety of country rock, including hornblende gneiss and biotite gneiss, but many are near or in contact with coarse-grained gray marble. Most of the bodies are fine- to coarse-grained peridotite, dunite, and pyroxenite, but a few are largely hornblende gabbro, hornblendite, and pyroxene gabbro.

What appears to be the largest single ultramafic-mafic body in the study area is located on the ridge east of the Speel River about 6 km (4 miles) above the rapids. Although poorly known at present, this body apparently consists mainly of hornblendite, hornblende gabbro, and peridotite surrounded by hornblende gneiss.

As discussed in a later section, the ultramafic body at Windham Bay has minor copper and iron mineralization associated with it. The other bodies do not appear to contain anomalously high amounts of metallic elements.

Granitic rocks of Cretaceous(?) age

Three granitic rock units of Cretaceous(?) age are present in the study area and vicinity. In mapping the granitic units have been called 1) biotite granodiorite and hornblende-biotite granodiorite, 2) Speel River-Fords Terror foliated tonalite, and 3) porphyritic garnet-biotite-hornblende diorite. On plate 1, the first two of the above list have been included in the foliated biotite-hornblende quartz diorite unit (Kgqd) and the third is the porphyritic garnet-biotite-hornblende diorite (Kgdp) unit. All of these units have steep contacts with adjacent units.

Biotite granodiorite and hornblende-biotite granodiorite crop out on both sides of Endicott Arm near the terminus of the Dawes Glacier. The rocks are of foliated fine- to medium-grained, C.I. (Color Index) 20-40, biotite granodiorite and(or) tonalite, hornblende-biotite granodiorite, biotite-hornblende quartz diorite, biotite quartz diorite, sphene-biotite-hornblende diorite, and hornblende granodiorite. The rocks are locally migmatitic to heterogeneous; they locally include small to large masses of phyllite, calc-silicate rock, hornblende schist, and biotite schist. The contacts are generally gradational with adjacent map units, but sharp contacts do exist.

There is no direct evidence of the age of these granitic rocks. They appear to be pre- or synkinematic with the inferred Late Cretaceous deformation and metamorphism. The bodies appear to predate the deformation associated with the emplacement of the Endicott Arm gneiss dome. No direct field relationship with the mid-Tertiary granitic bodies is known.

There are no metallic mineral deposits clearly associated with this unit.

The informally named Speel River-Fords Terror foliated tonalite is a generally sill-like body from 3 to 8 km (2 to 5 miles) wide that extends from well beyond the study area to the south to beyond the northwestern boundary of the study area, a total of over 80 km (50 miles). The unit consists of foliated generally homogeneous medium- to coarse-grained, C.I. about 20-25, biotite-hornblende quartz diorite and tonalite, hornblende-biotite quartz diorite and tonalite; minor biotite-hornblende granodiorite and quartz monzodiorite. Modal analyses cluster in the adjoining parts of the granodiorite, tonalite, and quartz diorite fields of the quartz-alkalic feldspar-plagioclase feldspar IUGS (Streckeisen, 1973) triangle (fig. 6).

Figure 6 near here.

This map unit generally has sharp contacts with adjacent units; small apophyses are locally abundant and complex larger scale digitation is present east of Mount Sumdum (pl. 1). The outer parts of the unit locally contain screens and inclusions of the country rock and several larger screens occur within the body (pl. 1); the latter are more common southeast of Fords Terror.

This unit also includes two bodies of porphyritic biotite granite, one lying 0.8 km (one-half mile) east of the entrance to Fords Terror and the other 10 km (6 miles) to the northwest. The rock is a homogeneous, foliated, fine- to medium-grained, C.I. 5-10, biotite granite with prominent feldspar phenocrysts. Biotite-hornblende-feldspar gneiss, calc-silicate rock, and biotite-quartz-feldspar gneiss are mixed with the biotite granite near its contacts.

FIGURE 6 -- QUARTZ - ALKALIC FELDSPAR - PLAGIOCLASE FELDSPAR IUGS TRIANGULAR DIAGRAM SHOWING MODAL COMPOSITIONS OF ROCKS FROM THE SPEEL RIVER - FORDS TERROR FOLIATED QUARTZ DIORITE UNIT

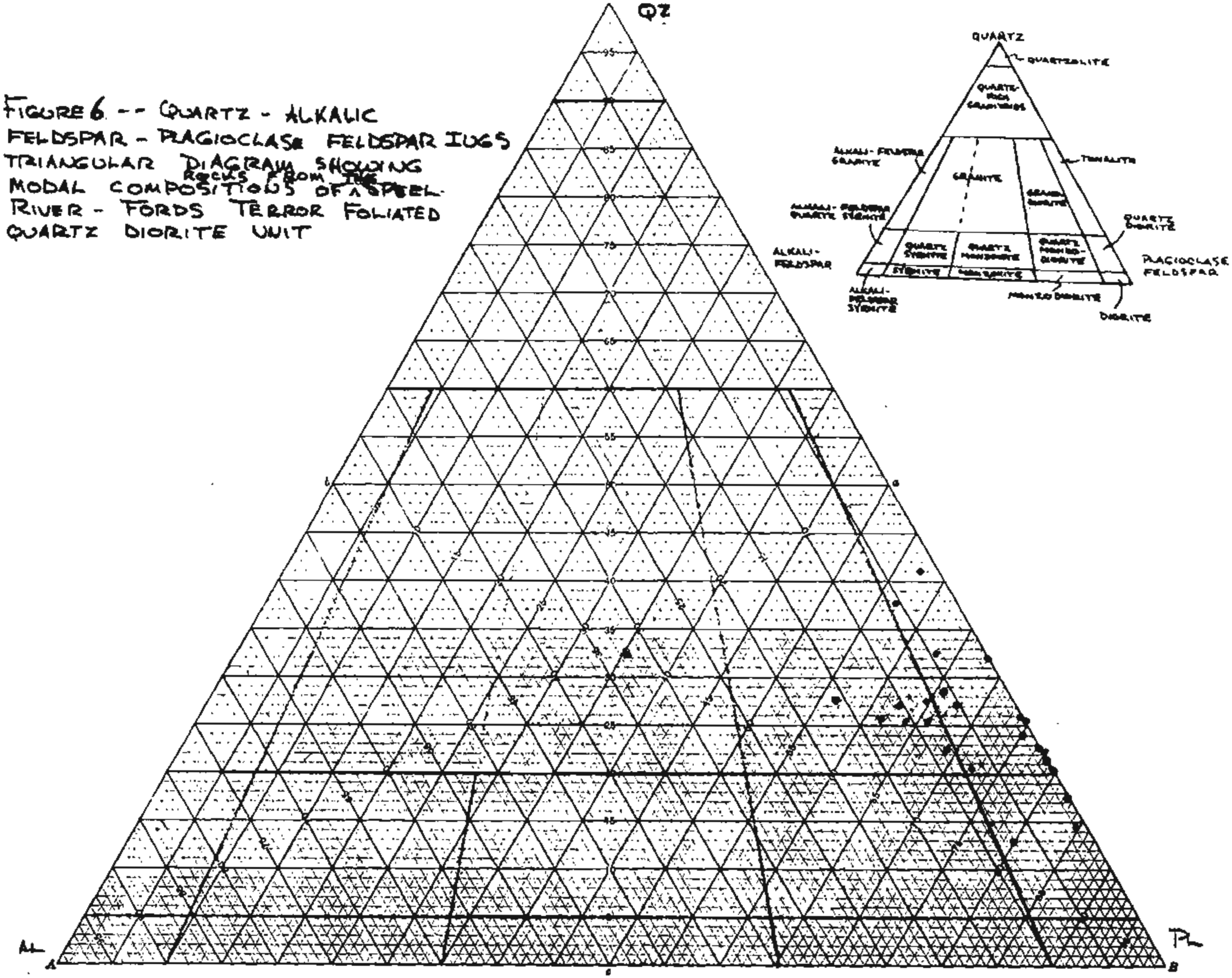


Figure 6.--Quartz-alkalic feldspar-plagioclase feldspar IUGS triangular diagram showing modal compositions of rocks from the Speel River-Fords Terror foliated tonalite unit, Tracy Arm-Fords Terror Wilderness Study Area, Alaska.

The Cretaceous(?) age assigned to this unit is based in part on the same structural and metamorphic relations noted earlier for the biotite granodiorite and hornblende-biotite granodiorite unit and in part on discordant K-Ar ages on biotite-hornblende mineral pairs (J. G. Smith, unpub. data). Although not conclusive, the latter suggest an almost complete resetting of the K-Ar system in the biotites and a partial resetting in the hornblendes at the time of the Tertiary intrusions; the minimum age indicated is 66 m.y. Souther (1971) assigned an Early or Middle Triassic age to a foliated quartz diorite unit well to the east of the main Coast Range. Those rocks generally have less quartz than the rocks of the Speel River-Fords Terror foliated tonalite unit. It is mentioned here because it occupies the same relative position in Souther's sequence of intrusions as the Speel River-Fords Terror body does in the sequence described here.

The Sumdum copper-zinc (MacKevett and Blake, 1964), Tracy Arm zinc-copper (Gault and Fellows, 1953), Portland Group gold (Herreid, 1964) prospects and other deposits in the Sumdum Glacier mineral belt are spatially associated with the southwestern contact of this body. MacKevett and Blake (1964) conclude that the Sumdum copper-zinc deposit probably postdates at least the main deformation and intrusion in this part of the Coast Range, but leave open the possibility that the ore constituents were derived from late-stage fluids associated with the Coast Range batholith. The present study concludes that the deposits have been deformed and metamorphosed.

The porphyritic garnet-biotite-hornblende diorite unit is essentially restricted to the Endicott Peninsula, occurring both as stocks and as sill-like masses of variable size. Best low-elevation exposures of the unit are found along the north shore of Windham Bay and the north shore of Sand Bay.

The unit is composed of foliated and porphyritic, fine- to medium-grained, C.I. 25-50, garnet-biotite-hornblende quartz diorite, hornblende quartz diorite, hornblende-biotite diorite, and minor foliated, nonporphyritic fine- to medium-grained, C.I. 15-20, biotite-hornblende granodiorite.

The sill-like bodies are mostly highly chloritized hornblende diorite. Garnet is most common in the outer parts of the larger bodies; those bodies have conspicuous layering. Contacts everywhere are sharp.

Gneiss dome rocks of Tertiary or Cretaceous age

One well-developed and two less well-developed unusual gneiss domes (TKgn) a few square kilometers in area are exposed in the study area. A probable extension of the well-developed and informally named Endicott Arm gneiss dome has also been studied outside of the study area. The other two features are called the Tracy Arm and Dawes Glacier domes. All of the domes have steep sides which flatten gradually upward towards the gently plunging crests.

The Endicott Arm gneiss dome is located near where North Dawes Glacier approaches Endicott Arm (pl. 1) and its probable extension is exposed to the south of the nearby study area boundary. The gneiss dome core rocks are homogeneous, medium- to coarse-grained, poorly foliated, C.I. 5-10, biotite-quartz-feldspar gneiss and garnet-biotite-quartz-feldspar gneiss. Compositionally these gneisses are granodiorites. These core rocks are in general in sharp contact with the surrounding schists and darker gneisses, but locally screens or inclusions of schist occur near the margins parallel to the contact and to the foliation in the core.

There is no direct evidence of the age of the gneiss dome core. Deformation of older structures by the domes of inferred Late Cretaceous age indicates that the doming is younger than those structures. There is some suggestion (pl. 1) that the dome also deformed the nearby granitic rocks of Cretaceous age (Kgqd) described above. No relation has been established between the core rocks and the granitic rocks of Tertiary age described below.

The Dawes Glacier gneiss dome underlies that glacier near its terminus and is separated from the Endicott Arm gneiss dome by the foliated biotite-hornblende tonalite (Kgqd) unit. It is compositionally and structurally similar to the Endicott Arm dome but is not as obvious a feature. Part of the Dawes Glacier dome was mapped as biotite-hornblende granodiorite in the field and part as quartz diorite. Locally, the dome is moderately to very heterogeneous and consists of foliated medium- to coarse-grained, C.I. 15-30, biotite-hornblende granodiorite, sphene-biotite-hornblende quartz diorite with abundant inclusions of fine-grained foliated hornblende diorite and garnet-biotite gneiss, minor biotite quartz monzonite, and migmatite. Inclusions locally make up to 40 percent of the rock and minor diopside-wollastonite-marble screens occur. The contact is apparently gradational and irregular to the west with a narrow band of heterogeneous schist, gneiss and calc-silicate rocks.

The Tracy Arm gneiss dome, which underlies Tracy Arm about 11 km (7 miles) from its head, was mapped in the field as foliated biotite-hornblende quartz diorite and biotite granodiorite. This dome is long and narrow (pl. 1) and its northern contact difficult to trace with certainty.

The gneiss domes are alined north-northwest at a small angle to the dominant northwest strike of rock units and structures. No other gneiss domes have been recognized in this part of the Coast Range. No relation between mineralization and the domes has been established.

Granitic rocks of Tertiary age and associated migmatites

A large part of the study area near the International Boundary is underlain by granitic rocks of Tertiary age (Tegr), mapped mainly as hornblende-biotite granodiorite (fig. 1; pl. 1). To the north, this belt widens westward. There are also scattered nearby granitic bodies that are inferred to be Tertiary in age. Both types of occurrences have associated migmatites (Temg). All of these granitic bodies and migmatites appear to have steep contacts with adjacent units.

In general, the main granitic area along the boundary is made up of locally porphyritic, nonfoliated, medium- to coarse-grained, C.I. 10-20, sphene-hornblende-biotite granodiorite, sphene-biotite-hornblende granodiorite, hornblende granodiorite and sphene-biotite-hornblende granite. The modal analyses spread across the lower parts of the granite, granodiorite, and tonalite fields (fig. 7) of the IUGS plutonic

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Figure 7 near here.

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rock classification diagram (Streckeisen, 1973). The scattered granitic bodies to the southwest (pl. 1) are locally foliated and are mapped as hornblende granodiorite, foliated hornblende granodiorite, garnet-biotite granodiorite, and biotite quartz diorite and biotite granodiorite.

Figure 7.-- Quartz- alkalic feldspar- plagioclase feldspar IUGS triangular diagram showing modal compositions of Tertiary granitic rocks and associated migmatites from the Tracy Arm- Fords Terror Wilderness Study Area, Alaska

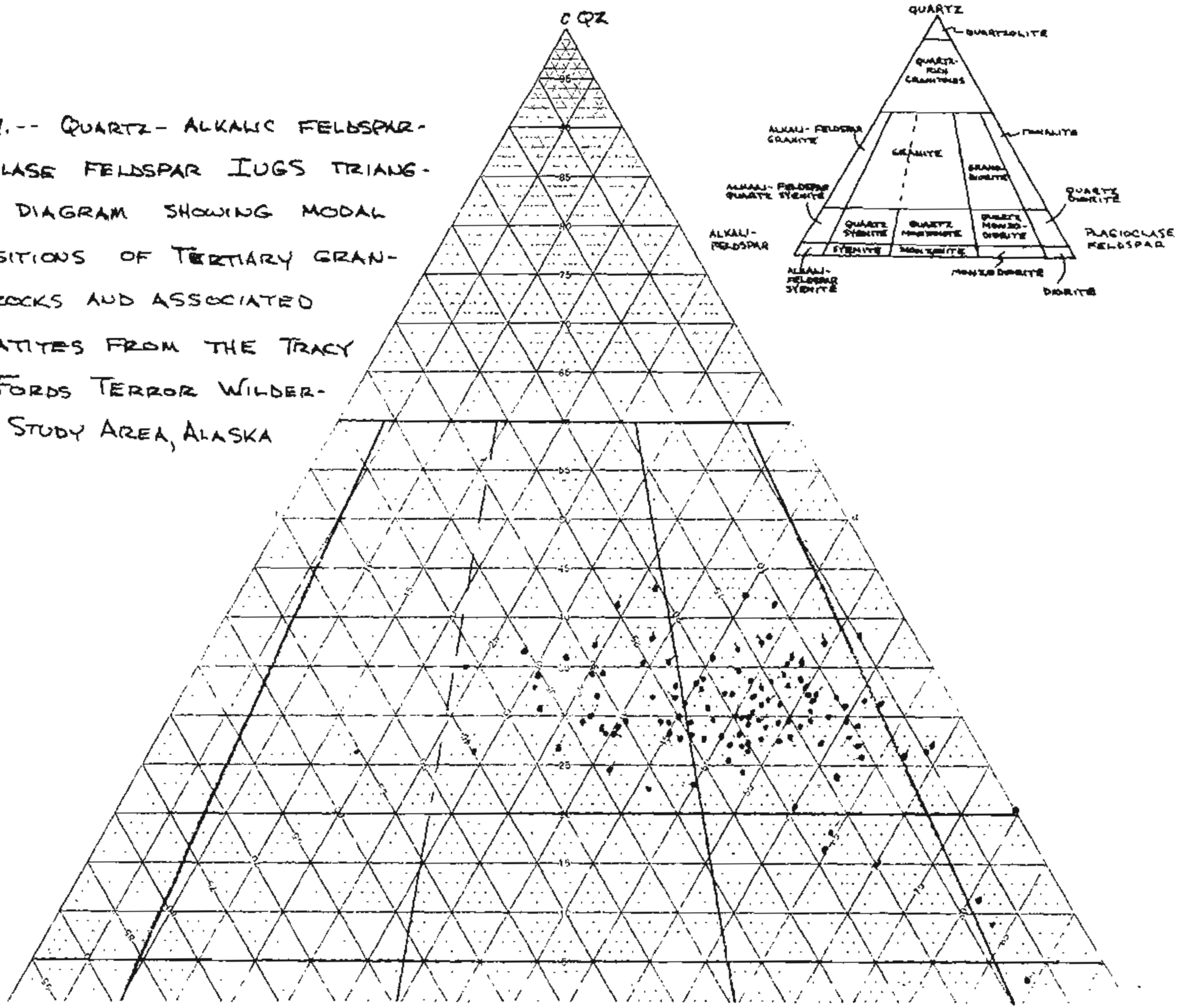


Figure 7.--Quartz-alkalic feldspar-plagioclase feldspar IUGS triangular diagram showing modal compositions of Tertiary granitic rocks and associated migmatites from the Tracy Arm-Fords Terror Wilderness Study Area, Alaska.

Migmatites have been mapped extensively along the southwestern side of the granitic area along the International Boundary and with some of the scattered bodies (pl. 1). The migmatite consists of moderately to very heterogeneous stockwork, agmatite, and banded gneiss with mainly hornblende-biotite granodiorite, biotite-hornblende quartz monzonite, biotite granite, biotite-hornblende granite, and biotite-hornblende quartz diorite cutting and including hornblende diorite, biotite-hornblende diorite, quartz-plagioclase-hornblende gneiss, biotite-hornblende quartz diorite, biotite-hornblende gneiss, amphibolite, biotite-quartz schist, and some calc-silicate rock. Modal analyses of the granitic phase of the migmatites suggest that it may be slightly more alkalic than the main Tertiary granitic unit.

The Tertiary granitic rocks in the southern part of the study area are commonly bordered by the associated migmatite unit; elsewhere the migmatites are local and discontinuous. The scattered granitic bodies are either within or adjacent to migmatite bodies. The migmatites themselves generally have relatively sharp contacts with the unfoliated hornblende-biotite granodiorite, with the other granitic rocks, and with various gneiss and schist units. The latter contacts are, however, locally gradational.

The age assignments given for the Tertiary granitic rocks (pl. 1) are based on K-Ar dating of biotite and hornblende mineral pairs from various parts of the granitic units (J. G. Smith, unpub. data). In brief, the mineral pairs give concordant ages in the range 49 to 54 m.y. These ages are similar to unpublished ages from similar rocks in the Juneau Icefield area (J. G. Smith, unpub. data) and published ages from that same area (Forbes and Engels, 1970). They differ significantly from the 69-m.y. biotite age cited by Souther (1971, p. 37) as from lithically correlative rocks to the northeast across the International Boundary.

Immediately across the boundary near Mount Ogden (pl. 1) there are known molybdenite deposits associated with Souther's "younger quartz monzonite" and there are copper-molybdenum deposits nearby elsewhere in that unit (Souther, 1971). In the Juneau Icefield area, Brew and Ford (1969) described a small molybdenum-silver occurrence associated with granitic rocks which were mapped nearby by Souther as "central plutonic complex", which he considered to be older than the "younger quartz monzonite." These Juneau Icefield rocks are those which give K-Ar ages around 50 m.y. The available evidence suggests that 1) Souther's "central plutonic complex" and "younger quartz monzonite" are closely related, 2) both are probably correlative with the Tertiary granitic rocks of the Tracy Arm-Fords Terror area, and 3) this group of intrusives has locally associated molybdenum and copper deposits.

Comparison of Souther's (1971, p. 35) plot of modal compositions of specimens from his "younger quartz monzonite" and "central plutonic complex" units with figure 6 shows that Souther's "central plutonic complex" specimens more or less are in the same field as the Tertiary granitic rocks and specimens from his "younger quartz monzonite" are in the same general field as granitic rocks from the migmatites.

Surficial materials

Holocene surficial deposits (Qs) occur along the floors and sides of most valleys and glacier and permanent snowfields (Qi) cover perhaps 25 to 30 percent of the study area.

The surficial deposits include recent alluvium along lesser gradient parts of streams, colluvium on almost all hill slopes, talus, landslide deposits, ice-contact glacial deposits, glacial outwash deposits, supraglacial drift, and a few prominent moraine deposits probably related to glacial advances. Moraines probably related to both Hypsithermal and more recent advances are preserved, but no older deposits appear to be present.

The permanent snowfields and glaciers occur in systematic relation to topography and to tidewater; no glaciers are present within about 13 km (8 miles) of Stephens passage; to the northeast inland is a several-kilometer-wide zone with small cirque, carapace, and valley glaciers; then a similar zone but with tidewater glaciers entering the heads of the large fiords. Large icefields along the International Boundary form the most inland zone; here only scattered nunataks protrude above the ice plateaus which feed the large tidewater glaciers.

Structure

The general structure of the Coast Range batholith part of the Tracy Arm-Fords Terror Wilderness Study Area appears to contrast strongly with that of the western metamorphic belt. This is because the large amount of granitic rock, the isolation of the screens and pendants of metamorphic rock, and the much greater proportion of gneisses in the batholithic part make it much more heterogeneous than the western belt (pl. 1). This contrast is also apparent on a smaller scale in regard to faults and folds, but, as the brief following discussions show, it may not indicate a real difference in deformational history.

The Speel River-Fords Terror sill, whose emplacement is considered likely to have been structurally controlled, separates the western metamorphic belt and the batholithic complex. It is inferred (Brew and others, 1976) to be greater than 225 km (140 miles) long altogether and, except at its northern terminus as the Mount Juneau pluton (Ford and Brew, 1973), it closely coincides with the boundary between the coarser-grained gneisses and granitic rocks of the batholithic complex and the schists and quartzites of the higher grade part of the western metamorphic belt. The foliation in the sill parallels that in the adjacent rocks. It probably was intruded along a discontinuity of some kind and is syn- or late tectonic.

The structural discontinuity just mentioned is close to and consistently parallel to the "Coast Range megalineament;" a structure which extends the length of southeastern Alaska and which is locally a fault (Brew and Ford, 1977b). Within the study area the megalineament is expressed as either a strong topographic low, as in Port Snettisham, the mouth of Tracy Arm, and Endicott Arm, or as a very strongly grained terrane, as on the mountain sides bordering the above areas and across the mountains and ridges south of Endicott Arm (pl. 1). The width of the megalinear zone is about 13 km (8 miles) maximum and its length within the study area is about 68 km (42 miles). The megalineament, like the Speel River-Fords Terror sill, is about parallel to the strike of the foliation and of most bedrock map units. It is considered to be a fault in the study area; the only evidence for displacement consists of the apparent 10-km (6-mile) right-lateral separation of the biotite isograd in Endicott Arm. The map pattern could result from various combinations of northeast-side-up, right-lateral movements. As discussed in the sections on aeromagnetics and gravity, the megalineament is also the zone of abrupt geophysical gradients.

Many other lineaments are shown on the geologic map (pl. 1). Most of those in the batholithic complex are probably well-developed joints or small faults that do not offset mapped contacts. Many of the lineaments in the western metamorphic belt are parallel the foliation and express it, are joints, or are related to the Coast Range megalineament.

Northeast-trending lineaments on the Snettisham Peninsula just outside of the study area to the northwest are small faults; distinctive limestone and dark shaly phyllite units generally show several hundred meters of right-lateral separation that could be due to various combinations of right-lateral and northwest-side-up movements. Two of the faults are significant because they continue northeastward into two prominent lineament zones about 3 km apart, one along the Whiting River valley and the other in the Sweetheart Lake valley. No significant offset of mapped contacts occurs along these valleys, but the available control would not define relatively small separations.

The lineaments do not appear to have any direct mineral resource significance.

Little data are available on fold styles and deformation in the gneisses of the Coast Range batholithic complex. The coarser grain of these rocks, as compared with those of the western metamorphic belt, makes preservation and recognition of minor structural elements less likely. There appears to have been small- and large-scale isoclinal folding about moderately to steeply plunging axes with steep northeast-dipping axial planes; plunges range from northwest around to southeast.

As noted earlier, the Speel River-Fords Terror tonalite sill is well foliated. Foliation is present locally in the migmatite units associated with Tertiary granitic bodies in the batholithic complex, but it is probably related to the emplacement of the granitic bodies rather than to larger scale penetrative deformation. The granitic bodies themselves are generally not foliated but some, particularly where the granitic belt broadens to the west between Tracy Arm and the Whiting River, are consistently foliated.

The rocks of the western metamorphic belt record at least two deformational episodes. In a few places, such as Bushy Island in Endicott Arm, along the northeast shore of Endicott Arm, and at the Sumdum copper-zinc prospect, evidence suggests the presence of isoclinal folds with amplitudes of more than a kilometer and wave lengths of about a kilometer. Elsewhere any large-scale folds that were originally present must have been transposed and had their hinges destroyed.

In general, the mesoscopic structures indicate a dominant northwest-striking, northeast-dipping foliation, and most fold axes plunge steeply to moderately in the arc from northwest through east to southeast. Analysis of structural data from both sides of northern Endicott Arm suggests that this is only the grossest kind of representation of the actual structure. Geometric analysis of the relatively abundant structural data from that area suggests two main episodes of folding: the first, probably involving original layering and contacts, being isoclinal about moderately to gently north-northwest-plunging axes; and the second, probably involving foliation and layering developed parallel to the axial planes of the first folds, being isoclinal about moderately to steeply southeast-plunging axes. Unfortunately, there are no key layers to clearly verify this suggestion at either macrostructural or mesostructural scale. Loney (1965) has shown the complexity of deformation in an area about 64 km (40 miles) to the southwest across Stephens Passage.

The age of the folding in the batholithic complex and in the western metamorphic belt is not tightly bracketed. There is no evidence that the two areas were deformed separately, although that is a possibility; thus the age relations inferred from the western belt are here considered to apply to both areas. Based on regional paleontologic and lithologic evidence, the original age of the youngest metasedimentary and metavolcanic rocks in the western belt is considered to be Late Triassic. It is possible that Upper Jurassic and Lower Cretaceous units are also present, but there is no definite evidence. The upper limit is controlled by the age of the Speel River-Fords Terror foliated tonalite; its foliation appears to be related to the latest fold episode and it was probably emplaced during or shortly after that deformation. The Speel River-Fords Terror body lithically and structurally resembles granitic bodies of middle Cretaceous age known elsewhere in southeastern Alaska (Loney and others, 1967). As discussed previously in this report, efforts to date this body by the K-Ar method on coexisting biotite and hornblende pairs have either yielded 1) ages equal to those of the cross-cutting, generally nonfoliated mid-Tertiary granodiorites along the International Boundary, which probably indicate complete resetting of the K-Ar system in both minerals at that time, or 2) discordant ages with biotites giving the mid-Tertiary age and hornblendes giving an Early Tertiary age, which indicate partial resetting of the system in the hornblende. The minimum age for the sill and for the deformation is considered mid-Tertiary and it is likely that it is at least as old as Late Cretaceous. These lines of reasoning all are compatible with a middle to Late Cretaceous age for the main deformation and metamorphism in the study area.

Two other types of structural features are present in the study area; one is a series of unusual gneiss domes and the other is the belt of small ultramafic bodies which could indicate emplacement along a pre-existing structural feature. The granodiorite gneiss domes are located (pl. 1) on Tracy Arm east of the Speel River-Fords Terror tonalite sill and at the head of Endicott Arm on either side of that sill. They are steep-sided but their axes appear to plunge moderately to gently away from the high points. Internal foliation follows their external form. One of the domes seems to have deformed the structures described above in the western metamorphic belt, superimposing lineations parallel its axis on the earlier structural elements. The age of emplacement is inferred to be younger than the Late Cretaceous(?) Speel River-Fords Terror sill and older than mid-Tertiary granodiorites along the International Boundary, which are unlike the gneiss domes in lithology and style. It is possible that these domes are the cores of large-scale antiforms.

The belt of discontinuous ultramafic bodies extends for 100 km (62 miles) in a north-northwesterly direction through the gneisses of the batholithic complex (pl. 1). The belt is a maximum of 19 km (12 miles) wide and the individual bodies range in size from a few meters to 4 km (2.5 miles) in maximum dimension. The compositions of the various bodies are described in a section of this report dealing with rock units. The trend of the ultramafic belt is only slightly different than the strike of most of the units in the western metamorphic belt and the belt probably represents an original pre-metamorphic, pre-intrusive concentration of ultramafics.

Of the structures described in this section, the folds in the western metamorphic belt and the possible Speel River-Fords Terror structural discontinuity appear to have a direct relation to mineral-resource potential evaluation. Clear evidence from some of the known metallic mineral occurrences in the western metamorphic belt indicates that at least some of the sulfide mineralization predates the folding and metamorphism, thus the source of that mineralization is older than most of the recognized intrusive history. The Speel River-Fords Terror foliated tonalite sill forms the northeastern boundary of the favorable Sumdum Glacier mineral belt and the origin of that boundary may have had a critical influence on the localization of metallic mineral occurrences.

Geomorphology and Quaternary geology

The Tracy Arm-Fords Terror Wilderness Study Area lies mostly within the Boundary Ranges subprovince and partly within the Coastal Foothills subprovince, which together make up the Coast Mountains province of the Pacific Mountain System of Wahrhaftig (1965, pl. 1, p. 43). The boundary between the subprovinces within the study area coincides approximately with the Coast Range megalineament which forms a prominent northwest-trending trough in the Port Snettisham and Holkam Bay areas and a strikingly parallel-grained terrane where it leaves Endicott Arm to the south.

The geomorphology and Quaternary deposits are important to the mineral-resource appraisal to the extent that they facilitate or hamper access and because of the way in which they influence geochemical sampling and hence interpretation of geochemical data.

The Coastal Foothills consist of heavily forested rounded mountains with a maximum relief of about 1,200 m (4,000 feet) in the study area. The higher elevations have small cirques and arêtes and some lower valley walls are very steep, but the overall impression is of relatively broad valleys and lower subdued summits.

The lower hillslopes are mantled with colluvium, some small landslide deposits are present, and the valley bottoms locally contain thin and discontinuous glacial deposits in addition to alluvium along the present streams.

This area was covered by a late Pleistocene ice sheet the top of which was at an elevation of 1,200 to 1,800 m (4,000 to 6,000 feet) (Coulter and others, 1965) and any extensive glacial deposits in the valleys are probably from that advance. However, the ice sheet apparently removed any evidence of previous glaciations and didn't leave much of a record of its own. Marine deposits like those of late Pleistocene and early Holocene age described by Miller (1972, 1973) near Juneau have not been recognized in the area. If present, they would postdate any major ice sheet coverage.

The Boundary Ranges subprovince is typified by the deep fiords such as Tracy Arm, Fords Terror, and Endicott Arm; the high rugged mountain peaks to 2,470 m (8,095 feet) with their abundant hanging, carapace, and cirque glaciers, steep peaks and arêtes; and by the broad dentritic icefields that feed the tidewater glaciers which enter the heads of Tracy and Endicott Arms. The larger parts of these icefields are across the International Boundary in British Columbia; nevertheless the parts within the study area have ice exposures as much as 16 km (10 miles) across broken only by scattered nunataks.

The Boundary Ranges subprovince is here broken into three blocks by the long and low alluvium-filled valleys of the braided Speel and Whiting Rivers which extend from tidewater to the International Boundary. Another low-level valley containing Crescent Lake and an unnamed lake near Speel River rapids connects between these two major valleys and isolates an unusual 20- by 30-km (12- by 18-mile) block that has remarkably concordant summits at about 1,400 m (4,500 feet).

The most obvious Quaternary deposits are the alluvial flats of the large rivers and the alluvial-colluvial material flooring U-shaped valleys below retreated glaciers. The lower mountainsides are generally free of extensive colluvium except in well-defined talus deposits. The remnants of two large terminal moraines, one across the mouth of Tracy Arm between Sand Spit and the south side of the Snettisham Peninsula and one across the mouth of Endicott Arm from the same Sand Spit to Wood Spit, are undated, but they must postdate any more extensive ice sheet. They could correlate with deposits of late Pleistocene and early Holocene age in the Juneau area (Miller, 1972, 1973). An apparently younger terminal moraine that probably resulted from the stand of a now-retreated glacier (on the south flank of the Mount Sumdum peak area) occurs at the mouth of the creek about due north of Bushy Island in Endicott Arm. Some of the abandoned higher elevation cirques contain small terminal moraines and most of the active glaciers have associated terminal and(or) lateral moraines.

It appears as if all of the glaciers in the study area are presently retreating and lowering their surfaces. Between 1929 and 1974 the tidewater Dawes Glacier retreated an estimated 5 km (3 miles).

There are a few small glacier-dammed lakes in the study area (Post and Mayo, 1971). None are known to discharge regularly. Only the one adjacent to the Speel Glacier near the International Boundary is likely to significantly affect the valley downstream from it.

Current and past glacier-related processes clearly dominate the development of the landscape and surficial deposits in the study area. Most of the stream sediments in the area are probably only slightly transported bedrock material. This, however, is not true for the major low-level rivers and probably is not true for the bottoms of those U-shaped valleys relatively recently abandoned by glaciers. In both of these situations the local material is probably appreciably diluted by distant-source material. The influence of these effects is discussed in the section of this report dealing with geochemistry.

Interpretation of the aeromagnetic data

by

Robert C. Jachens

An aeromagnetic survey of the Tracy Arm-Fords Terror Wilderness Study Area was flown and compiled by Geometrics in 1973. The survey covers approximately 5,000 sq km and extends somewhat beyond the northern and northwestern boundaries of the study area. Magnetic data were collected along lines oriented approximately N. 60° E. and spaced at 1.6 km. The aircraft maintained a nominal barometric altitude of 1,830 m, but the flight level was increased by 15 percent or more in some areas in order to allow the aircraft to operate safely above the higher topographic features.

The magnetic data originally were compiled at a scale of 1:63,360 and subsequently combined and reduced for publication to a scale of 1:125,000 (pl. 1). Plate 1 shows the residual magnetic intensity in gammas generated by removing from the observed data a datum of 57516 γ and a regional field of +2.02 γ/km north and +2.91 γ/km east. The regional field was removed using the 1965 International Geomagnetic Reference Field updated to 1973. Magnetic intensity contours are given at intervals of 10, 50, and 250 γ depending upon the magnitude of the local gradients.

As described in the introduction to this report, the study area is characterized by extreme topographic relief. In much of the region, peaks and ridges rise more than 1,500 m above the adjacent valley floors. Aeromagnetic maps over areas composed of magnetic rocks and having extreme topographic relief tend to display anomaly patterns that strongly correlate with the topography. For areas in high magnetic latitudes, such as the present study area, peaks and ridges tend to have associated magnetic highs while valleys tend to have associated magnetic lows. Amplitudes of topographically caused magnetic anomalies can be large, and they reach values of 600 γ or more in this area. These strong anomalies tend to mask the more subtle anomalies which might arise from minor differences in magnetic properties of the underlying rocks. As a result this interpretation of the aeromagnetic map in terms of geological structure is restricted to those features which give rise to anomalies that are larger than the topographic anomalies, are not correlated with the topography, or possess wavelengths which are substantially different from those of the topography.

In general, most of the prominent magnetic anomalies shown on plate 1 are caused by bodies of granitic and ultramafic rock. The metamorphic rocks of the western metamorphic belt appear to be essentially nonmagnetic as are many of the metamorphic rocks and migmatites of the Coast Range batholithic complex. Exceptions to this general statement apply to some gneisses and amphibolites of the Coast Range batholithic complex which appear to be, on average, slightly magnetic.

Measurements of the magnetic properties of a very limited sampling of rocks from the study area (table 2) tend to support the concept that

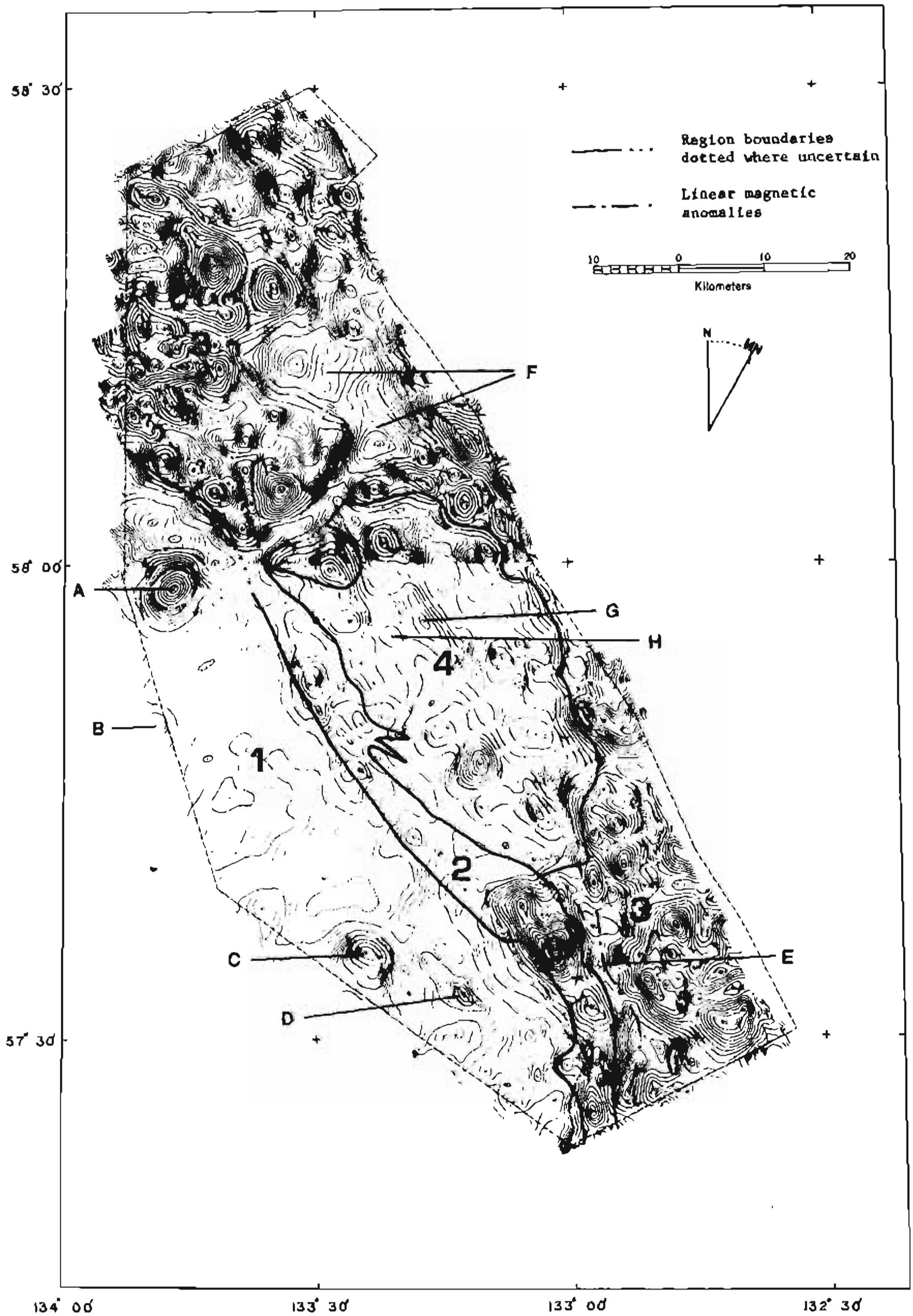
TABLE 2 NEAR HERE

the igneous intrusive rocks generally are more magnetic than the metamorphic rocks. The only sample of metamorphic rock which shows a moderate magnetic susceptibility (1.67×10^{-3} emu/cm^3) was obtained from a rock unit which has a weak magnetic high associated with it. None of the samples tested showed any appreciable remnant magnetization.

For the purposes of discussion, the aeromagnetic map has been divided into four regions on the basis both of magnetic character and correlation with the mapped geology (fig. 8). Also shown on figure 8 are specific

Figure 8 near here

magnetic anomalies designated by letters A-H which are not correlated with topography and which will be discussed in the following sections.



58° 30'
58° 00'
57° 30'
134° 00'
133° 30'
133° 00'
132° 30'
Region boundaries dotted where uncertain
Linear magnetic anomalies
10 0 10 20
Kilometers
N
MN
A
B
C
D
E
F
G
H
1
2
3
4

Figure 8.—Aeromagnetic map of Tracy Arm-Fords Terror Wilderness Study Area and vicinity showing specific anomalies and areas discussed.

Table 2.--Magnetic properties of some rocks from the Tracy Arm-Fords Terror Wilderness Study Area, Alaska

Rock Type	Symbol on Geologic Map	Number of samples	Magnetic Susceptibility (emu/cm^3)
Western Metamorphic Belt			
Greenschist and Greenstone	Kmgs	3	0.04×10^{-3}
Coast Range Batholithic Complex			
Granodiorite	Tegr	6	0.74×10^{-3}
Biotite gneiss	TKgn	1	0.14×10^{-3}
Quartz diorite	Kggd	2	0.66×10^{-3}
Granitic gneiss	Kmgn	1	0.05×10^{-3}
Biotite gneiss	Kmgn	1	1.67×10^{-3}

Region one corresponds, with minor exceptions, to the area described in the geology section of this report as the western metamorphic belt. Within the study area, the northeastern boundary of this region corresponds to the southwestern edge of the Speel River-Fords Terror tonalite sill (Kgqd), whereas outside the study area, it corresponds to the southwestern edge of the sill as inferred from the magnetic data. The topographic relief within this region, although generally not as severe as that in other portions of the study area, is greater than 1,200 m in some places. The magnetic field in region one is characterized by a smooth pattern of long wavelength, low amplitude anomalies. This pattern may result partially from the subdued topography of the region but mainly reflects the relative nonmagnetic character of the underlying rocks.

The smooth pattern is interrupted by four sharp local anomalies (A-D), two of which (A and B) lie outside the study area. The roughly circular anomalies A, B, and C are caused by ultramafic bodies (Kuum) which are exposed at the surface. Anomaly A, about 2,000 γ in amplitude and the largest anomaly on the map, lies over the magnetite-rich Port Snettisham ultramafic body (D. A. Brew, written commun.), anomaly B over ultramafic rocks exposed on the Midway Islands (D. A. Brew, oral commun.) and anomaly C lies over the Windham Bay ultramafic body which consists largely of clinopyroxenite. Model calculations using vertical prisms indicate that the Port Snettisham and Windham Bay bodies are similar geometrically. The Port Snettisham body has an upper face which is roughly 2 km by 3 km whereas that of the Windham Bay body is slightly larger, roughly 2 km by 4 km. Both bodies extend to depths at least on the order of the height of the survey aircraft above the local topography, about 1,600 m. The Port Snettisham body is almost vertical while the Windham Bay body dips to the south. These calculations also indicate that the Windham Bay ultramafic is somewhat larger than the surface exposures suggest and that its upper face is centered beneath the north shore of the bay, northwest of the mapped exposures. Because the two bodies are similar geometrically and occupy similar positions with respect to the survey altitude, the marked difference in amplitude of the magnetic anomalies associated with the two bodies indicates a significant difference in their relative magnetizations. This, in turn, suggests a significant difference in mineralogy between the two bodies, at least in terms of their magnetic mineral content. The Windham Bay body must contain a considerably lower percentage of magnetic minerals than the Port Snettisham body.

The elongate anomaly (D) located east of Windham Bay is substantially different in shape from the anomalies associated with the three ultramafic bodies. Its long axis is subparallel to the general trend of the foliation of the metamorphic rocks in the area and it cuts across many mapped contacts between geological units. This anomaly probably is caused by a narrow, shallow, steeply dipping dike approximately 10 km in length. Because of the spatial association between the southwestern contact of the Speel River-Fords Terror tonalite sill and some of the potentially economic mineral occurrences mentioned in the mineral resources section of this report, it should be noted that a 600-m-wide vertical dike reaching within about 700 m of the surface at its shallowest point and having an assumed relative magnetization equal to that of the nearby sill would generate a magnetic anomaly very similar to anomaly D. However, lacking other corroborating evidence, any hypothesis concerning a genetic relationship between the source of this anomaly and the nearby sill must be considered highly speculative.

The Cretaceous(?) granitic rocks of the Endicott Peninsula (Kgdp) have little magnetic expression. These rocks must be essentially nonmagnetic, in marked contrast to the other granitic rocks in the study area.

Region two is underlain by the Speel River-Fords Terror tonalite sill (Kgqd). The boundaries of this unit have been extended northwest and southeast of the study area on the basis of their magnetic expression. This rock unit is characterized by a discontinuous magnetic anomaly high along its southwestern contact and gives rise to the steep magnetic gradients encountered in crossing from the western metamorphic belt to the Coast Range batholithic complex. This gradient coincides with the Sumdum Glacier mineral belt. The discontinuous nature of the magnetic anomaly high results both from topographic influences and from highly variable magnetic properties associated with the rocks in this unit. The high variability of magnetic properties is well illustrated by the pronounced difference in anomaly amplitudes encountered in following the sill across Fords Terror. The change from anomalies reaching nearly 1,500 γ south of Fords Terror to anomalies of 200 γ to 300 γ immediately north of Fords Terror can be accounted for only partially by topographic effects. Magnetization variations of a factor of 10 or more in magnitude are necessary to account for the complete magnetic pattern. This variability possibly reflects differing degrees of metamorphism undergone by different parts of the sill.

Two dimensional model calculations indicate that the southwestern face of the sill is nearly vertical or dips steeply to the southwest. These calculations also indicate that the sill extends to considerable depth below the surface, on the order of 8 km or more in some regions, Region three is underlain by granitic rocks (Tegr), migmatites (Temg), and metamorphic rocks (Kmgn) of the Coast Range batholithic complex. The region is characterized over most of its extent by a magnetic pattern of moderate to high amplitude, short wavelength anomalies which correlate very well with the topography. This topographic correlation is well illustrated in the southeastern portion of region three by the long linear magnetic low which follows the South Sawyer Glacier and the line of magnetic highs adjacent to and to the west of this low. Along this line, the peaks of the magnetic anomalies tend to fall very close to the topographic peaks. Examples of this topographic correlation, such as the pronounced magnetic low which follows the Whiting River Valley, are also present in the northern portion of region three. Most of the apparent magnetic anomalies in this region are interpreted as being caused by topographic highs of the granitic rocks.

Two exceptions to this general statement are the linear magnetic low (anomaly E) adjacent to and east of the Speel River-Fords Terror sill south of Fords Terror and the broad magnetic low (anomaly F) located north of the Whiting River. These two anomalies are interpreted as being caused by screens of nonmagnetic metamorphic rock on the order of one to two kilometers thick overlying the magnetic granitic rocks.

Region four, bounded on the west by the Speel River-Fords Terror sill and on the south, east and north by the granitic rocks of Tertiary age, is underlain by igneous and metamorphic rocks of the Coast Range batholithic complex. The southern and eastern boundaries correspond to locations of steepest magnetic gradients. Model calculations indicate that at high magnetic latitudes the contacts between magnetic and nonmagnetic bodies lie beneath the steepest magnetic gradients. The northern boundary is not well defined magnetically and has been located on the basis of mapped surface contacts between granitic and metamorphic rocks.

The magnetic field in region four is characterized by numerous low to moderate amplitude anomalies rising above a base level approximately equivalent to the base level of the western metamorphic belt. In general, the high points of the magnetic anomalies are closely associated with peaks and ridges composed of amphibolite, granitic gneiss, and biotite gneiss (Kmgn) indicating that these rocks are the source of the anomalies. However, not all such amphibolites and gneisses in this region have associated magnetic anomalies.

The most prominent anomaly not associated with a metamorphic rock unit is anomaly G located just north of Tracy Arm. This anomaly is associated with the mapped exposure of a large granitic body. This body and the other smaller granitic bodies in region four are interpreted to be isolated bodies of limited dimension rather than the exposed portions of a large pluton which in most places is screened by overlying metamorphic rocks. The presence of a large pluton at depth having a magnetization equal to that of the granitic rocks in region three would result in a background level of magnetic intensity at least several hundred gammas higher than that of the western metamorphic belt. In addition, calculations indicate that the steep magnetic gradients along the eastern boundary of region four are caused by a contact between magnetic and nonmagnetic rock units which extends to considerable depth.

The ultramafic bodies (Kuum) of the Coast Range batholithic complex have very little magnetic expression, a feature which is in marked contrast to the large anomalies associated with the ultramafic bodies of the western metamorphic belt. Magnetic contours give no indication of the large hornblendite, hornblende gabbro and peridotite body exposed east of the Speel River. Near Tracy Arm, a weak magnetic high (anomaly H) probably is caused by a small pyroxenite whereas the lozenge-shaped peridotite body exposed 3 km west of anomaly H causes, at most, a slight deflection of the magnetic contours. None of the other ultramafic bodies of the Coast Range batholithic complex have any obvious magnetic expression. For the small ultramafic bodies, the lack of magnetic expression probably results from their limited size. However, the ultramafic body located east of the Speel River is relatively large in areal extent, shows 800 m of vertical exposure, and reaches within about 450 m of the survey altitude. Therefore, the lack of magnetic expression must result from low magnetization of the rocks in this body, significantly lower than the magnetization associated with the ultramafic rocks in the western metamorphic belt.

Interpretation of the available gravity data

by David F. Barnes

Available gravity field information indicates that a steep linear regional gravity gradient is spatially associated with the Sumdum Glacier mineral belt in the study area. The available gravity information is synthesized here to facilitate the geologic and mineral resource interpretation and evaluation of that belt and of the ultramafic body at Windham Bay.

No gravity data were collected during this investigation of the Tracy Arm-Fords Terror Wilderness area, but a small amount of data had been obtained during an earlier gravity reconnaissance of Southeastern Alaska. The latter survey was designed primarily to obtain data for a 1:2,500,000 gravity map of the whole state (Barnes, 1976) and to provide a regional background for possible local surveys aimed at interpretation of specific geologic structures. Thus the 100-plus measurements made in the vicinity of the study area were not designed to support a detailed geologic interpretation, although they do provide a basis for some regional conclusions and indicate a few local anomalies with probable geologic significance.

Most of the gravity measurements were obtained by skiff traverses in the 1969 field season during which the M.V. WATERS and R.V. DON J. MILLER II served as support vessels. These traverses provided data at intervals of about 3 km (2 miles) along the shorelines of all navigable waters and along much of the Alaskan length of the Whiting River. An additional 5 measurements were obtained while ferrying a helicopter between two geologic field parties during the summer of 1968. Sea-level corrected for tidal variations, river gradient supplemented by altimetry, and altimetry only on the helicopter traverse were used for elevation control, and the reduction density was 2,670 kg/m^3. Station locations, Bouguer anomaly values and 10-mgal contours were shown at a scale of 1:250,000 on an earlier release of data (Barnes, 1972a) and the principal facts and other aspects of the data were provided by accompanying reports (Barnes, 1972b, c; Barnes, 1972d; Barnes and others, 1972a, b; and Barnes, 1972e).

Figure 9 shows a more recent compilation of the data which has been

Figure 9 near here.

prepared for this study. The present compilation involves two changes from the earlier data release. First, the latitude correction has been changed from the 1930 International Ellipsoid to a new ellipsoid used in the 1967 geodetic reference system (Internat. Assoc. Geodesy, 1971). Second, the gravity datum has been converted from the old Potsdam datum (Woollard and Rose, 1963) to the new absolute gravity datum of the International Gravity Standardization Net 1971 (Morelli and others, 1974). These two changes make the data conform to the recent Alaskan gravity map (Barnes, 1976) and the Canadian gravity map (Canada Earth Physics Branch, 1974). In the study area the combined changes cause an anomaly decrease of about 7.1 mgal. The change in observed gravity datum is about 14.5 mgal, so new gravity values are provided for the two base stations used in the survey, which are also shown on figure 9. The base station 'SUMD' on Endicott Arm is located at Sumdum at the southeast door of the abandoned cabin, where the gravity on the ground below the hexagonal USGS gravity marker is 981,687.72 mgal on the new datum. Similarly the station 'QQ20' near the south end of Port Snettisham (Gilbert Bay) is northwest of the tidal flat on a prominent white quartz outcrop, where the gravity above another USGS marker is now 981,717.12 mgal.

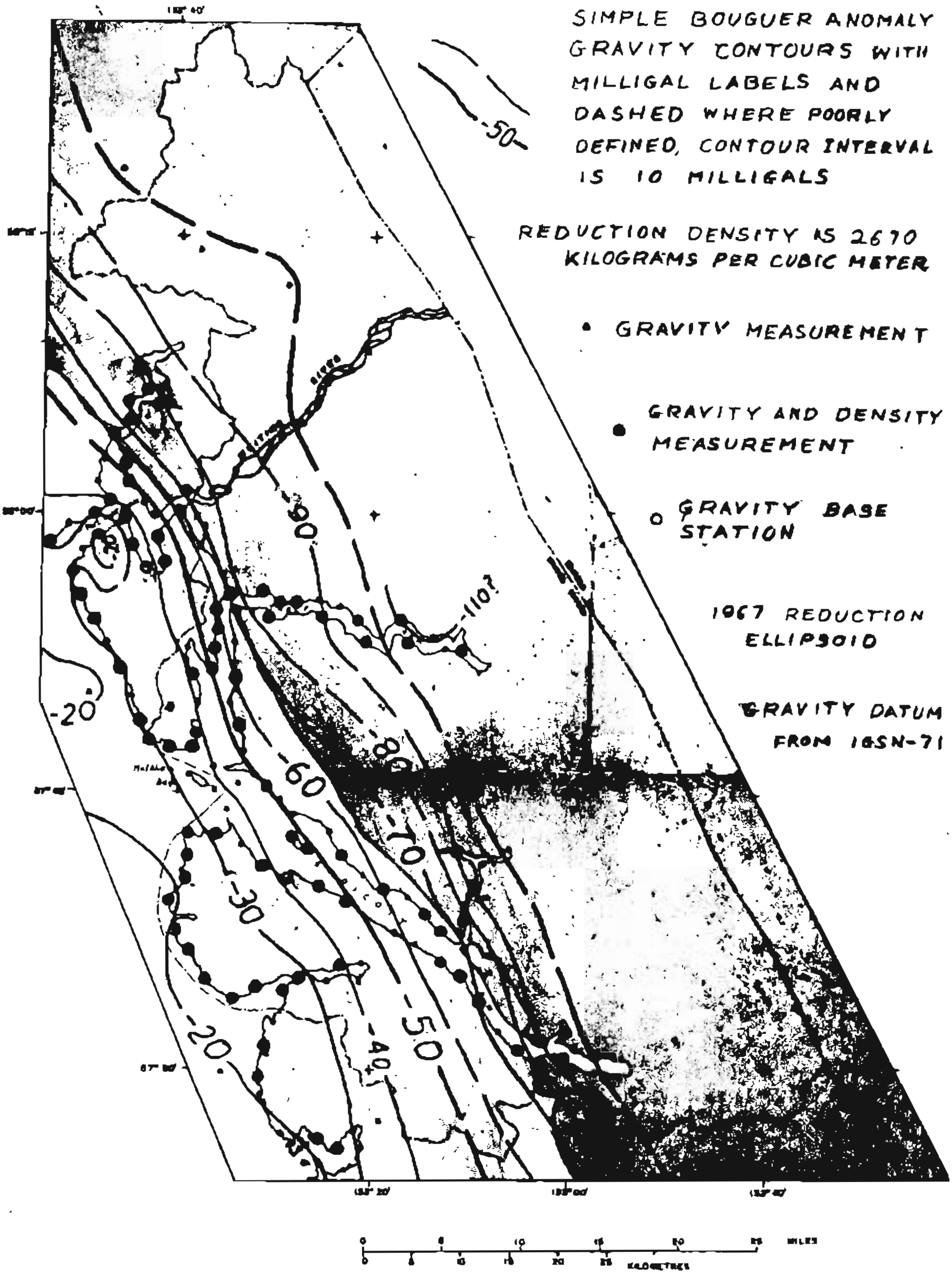


FIGURE 9 - BOUGUER GRAVITY MAP

Figure 9.--Bouguer gravity map, Tracy Arm-Fords Terror Wilderness Study Area and vicinity, Alaska.

The most prominent feature of the gravity field depicted in figure 9 is the belt of sub-parallel contours that approximately coincides with the western boundary of the Coast Range batholithic complex and the Speel River-Fords Terror sill. This belt of gravity contours represents a steepening of the regional gradient that extends throughout the length of southeastern Alaska and represents a change from high positive Bouguer gravities near the continental margin to anomalies as low as -120 mgal near the International Boundary. The steeper part of the gradient is caused by a combination of factors: 1) the probable gradual thickening of the crust from perhaps 15 km beneath the Gulf of Alaska to about 45 beneath the higher mountains of the Coast Range, 2) the increasing influence of uncorrected terrain effects as the topographic relief increases toward the eastern edge of the study area, 3) a suggested decrease in rock densities between the western metamorphic belt and the Coast Range batholithic complex. This contrast in rock density is probably most pronounced and extends to greatest depth along the trend of the Speel River-Fords Terror sill. Because the gradient is a combined effect of at least three factors, the relative importance of each factor would have to be assumed or calculated before estimating the thicknesses involved or modeling their possible configuration. The influence of the uncorrected terrain could be accurately but arduously calculated. A preliminary estimate suggests that it can account for 15 to 25 mgal of the anomaly.

During most of the southeastern Alaska gravity survey rock specimens were collected near many of the gravity stations and their densities were later measured in the Menlo Park laboratory. The locations of such specimen collections in the study area are shown in figure 9 and the resulting data are summarized in table 3. An obvious conclusion from

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TABLE 3 near here.

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both the map and the table is that the quantity of measured densities decreased from west to east because of the decrease in amount of shoreline accessible by skiff travel. Nevertheless the rock sampling is sufficient to show that the highest average densities were obtained in both the plutons and metamorphic rocks of the western belt. Furthermore, the sampling did not include any typical ultramafic rocks so the mean for the western plutons should be higher. A good mean density for pyroxenites and dunites sampled in other areas would be about 3,250 kg/m^2 (Daly and others, 1966). The table also shows that the lowest density rocks in the study area are the plutons in the eastern metamorphic belt, most of which are the Tertiary granodioritic rocks of the Coast Range batholithic complex.

Table 3. Densities of some Tracy Arm-Fords Terror rock units, in kilograms per cubic meter, from specimens collected during the reconnaissance gravity survey.

Rock Group	Number of Specimens	Density		
		Minimum	Maximum	Average
Western Metamorphic Belt	46	2650	3070	2810
Plutons in W.M. belt	6	2580	3010	2830
Speels River-Fords Terror sill	9	2700	2780	2760
Eastern Metamorphic Belt	8	2630	3000	2740
Plutons in EM Belt	4	2540	2660	2620

With this information one can make a very approximate estimate of the probable thickness of the Coast Range batholithic complex. The anomaly represented by the belt of parallel contours has a magnitude of about 75 mgals of which terrain corrections would probably reduce the anomaly to about 60 mgals. An anomaly of this amplitude could be entirely caused by crustal thickening of the magnitude suggested by empirical studies (Woollard and Strange, 1962). However, the steepness of the gradient for about 20 mgal near the Fords Terror sill suggests a shallower source of density contrast. This anomaly and a maximum density contrast of about 200 kg/m^3 between the plutons of the batholithic complex and the western metamorphic belt suggest by infinite-slab calculations that the minimum vertical dimension of the density contrast or the batholithic complex is about 2.5 km. The eastward flexure of the 100-mgal contour north of the Whiting River indicates a small positive anomaly of less than 10 mgal over a possible pendant of "eastern metamorphic rocks" within the batholithic complex. This suggests the minimum thickness of this pendant is close to that of the batholithic complex because the density contrast between the eastern metamorphic rocks and the granodiorites is about half of that which seems to be correlated with the anomaly of double this magnitude at the boundary with the western metamorphic rocks. Another local anomaly within the batholithic complex is at the eastern end of Tracy Arm where a short and questioned 110-mgal contour partly encloses two stations with lower Bouguer gravity. The terrain correction for these two stations would probably be sufficiently large to eliminate the anomaly but the two stations are on continuously exposed granodioritic rocks which form only small outcrops on the south shore of the arm, and thus suggest some geologic correlation of uncertain magnitude.

The most pronounced departure from linearity of the dominant contour trend and the only actual gravity closure on the map is a gravity high associated with the ultramafic rocks on the northern end of the Snettisham Peninsula. This anomaly has an amplitude of perhaps 15 mgal at the shoreline and is probably larger near the center of the outcrop area. A density contrast of 500 kg/m^3 and some infinite slab calculations modified by solid-angle approximations for the proximity of the probable margin of the ultramafic body suggest an intrusion thickness of at least 1 km and probably much larger if the anomaly increases towards the center of the outcrop. Slightly southwest of this anomaly is another small positive anomaly represented by the 20 mgal contours flexure from the map boundary to encircle a station on Midway Island where more mafic rocks were observed. In contrast two gravity stations near the ultramafic outcrops on Windham Bay do not indicate any gravity increase, suggesting that the intrusion is relatively thin. Finally the contour interval is too large to reveal a local gravity high with a magnitude of less than 5 mgal which occurs between the 90- and 100-mgal contours on Tracy Arm in the vicinity of another ultramafic outcrop. The small size of this anomaly suggests a limited size for the intrusion.

Geochemistry

By

Donald Grybeck, Bruce R. Johnson, and Constance J. Nutt

Introduction

Geochemical studies by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area concerned both active-stream sediments and bedrock. The stream sediment sampling program was designed to identify drainages or areas with anomalously high concentrations of one or more elements. These anomalous areas could then either be related to known occurrences of mineralized bedrock, or used as indicators of possible previously unknown mineralized bedrock localities. The bedrock sampling program provided information on the normal or "background" abundance of each element in each bedrock map unit and also on the concentration of metallic elements in altered and/or mineralized zones. Bedrock data were also used to aid in interpretation of stream-sediment data.

Stream-sediment samples were usually collected with helicopter transport in inland areas and with skiff transport along shorelines. Samples were collected prior to geologic mapping. Wherever possible, clay-sized or silt-sized material from active stream channels above the highest high-tide level was collected. Clay- or silt-sized material was difficult to obtain from streams with steep gradients and(or) adjacent to glaciers and some samples consisted mostly of sand-sized and larger material. Each sample was dried and screened and the minus 80-mesh fraction was analyzed according to procedures described in the introduction to this report.

The material sampled at different stream-sediment sites reflects differing weathering conditions and modes of metallic element transport. Although organic-free material was sought, most samples collected below timberline had a moderate organic content and a high clay-size material content. In these samples, scavenging of metals from solution by clays and iron oxides is considered responsible for a large portion of the metallic content. Samples from streams above timberline or adjacent to glaciers, even when composed of clay- or silt-sized material, are probably largely mechanically broken rock material and chemical solution and deposition is probably minor. Some of the major rivers flowing below timberline, e.g., the Whiting River, are also depositing fine sediments by the settling of glacial flour. These factors affect the amount of each metallic element obtained from each site. For these and other reasons, single anomalous stream-sediment samples were not considered as reliable indicators of possible mineralized bedrock as were closely-spaced samples with predominantly high values.

A bedrock sample (or samples) was collected for geochemical analysis at each geologic station. The number of these samples varies areally depending on access and the type of geologic mapping; in general, at least one sample was collected per square kilometer. Each distinct lithology present at each station was sampled and particular care was taken to sample all rocks with visible alteration, staining, or ore minerals. For this reason, the total bedrock sample population is considered somewhat biased toward samples high in metals of economic interest. These samples were not removed from the population and the background levels determined by subsequent statistical analyses may therefore be slightly high.

All samples collected were shipped to U.S.G.S. Branch of Exploration Research for analysis. Accompanying each sample was coded basic data such as sample location, sample type (rock or stream sediment), field number, etc. The geochemical analytical procedures used for all samples are discussed in the Introduction. The analytical results and the coded data were stored on computer disks at the Geological Survey, Denver, Colorado, DEC-10 computer installation using the RASS II program.

Over 5,000 samples collected by Geological Survey parties were processed and analyzed: 792 stream-sediment samples and 4,228 bedrock samples. All Survey sample locations in the area studied are shown on plate 2, but because of the large amount of data only samples which are anomalous in one or more elements are identified specifically. Complete analytical results for all geochemical samples are available through the National Technical Information Service (Forn and others, 1979).

The interpretation and synthesis of the geochemical information and the interpretation of geochemical distribution patterns depend on statistical analysis of the data. These analyses define threshold values above which special significance should be attached to analytical values. Because of the large volume of data, all statistical manipulations were performed on the computer using the RASS II and STATPAC-series programs.

The primary tool used to determine threshold levels of anomalous values for each element is a histogram of frequency of occurrence versus analytical value (example, see fig. 11). Since geochemical distributions are in general closely approximated by the log-normal distribution, a log-transformation was performed on all analytical values prior to plotting the histograms. The log-transformation allows the portion of the histogram which is above the detection limits for each element to be treated as an approximation to a portion of a normal distribution curve. A complete set of histograms was produced for all stream-sediment samples and for all samples in each bedrock map unit.

Because the stream-sediment samples are derived from different lithologies and because of site location variability and other factors, a single threshold value was not used for each element. Instead, two threshold levels were used: weakly and distinctly anomalous. Weakly anomalous values are those either in the upper 5 percent of the values or somewhat higher than normal geochemical abundance values; they may represent only variability due to sampling or analytical techniques and/or a higher background level for that element. Weakly anomalous values are considered significant only if they occur in clusters. Distinctly anomalous values are those in the upper 2 percent of the values for that element and so far above the normal geochemical abundance values that they suggest mineralization. The anomalous levels used for stream-sediment samples are given in table 4 and table 5 contains the analytical data for 138 stream-sediment samples which meet or exceed

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TABLES 4 AND 5 NEAR HERE.

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these levels in one or more elements. These sample locations are plotted and identified by sample number on plate 2.

Table 4. -- Levels of anomality for selected metals in stream sediments as used on plate 2 and figures 10 to 23.

Element	Weakly Anomalous at: (ppm)	Distinctly Anomalous at: (ppm)	Element	Weakly Anomalous at: (ppm)	Distinctly Anomalous at: (ppm)
Ag	$\gtrsim$ 0.7	$\gtrsim$ 3	Pb	$\gtrsim$ 50	$\gtrsim$ 100
As	$\gtrsim$ 300	none	Sn	$\gtrsim$ 10	$\gtrsim$ 20
Be	$\gtrsim$ 1.5	none	Au 1/	$\gtrsim$ 0.10	$\gtrsim$ 0.30
Cr	$\gtrsim$ 500	$\gtrsim$ 5000	Cu 1/	$\gtrsim$ 100	$\gtrsim$ 150
Cu	$\gtrsim$ 100	$\gtrsim$ 150	Hg 1/	$\gtrsim$ 0.04	$\gtrsim$ 0.10
Mo	$\gtrsim$ 10	$\gtrsim$ 20	Pb 1/	$\gtrsim$ 50	$\gtrsim$ 100
Ni	$\gtrsim$ 150	$\gtrsim$ 300	Zn 1/	> 200	none

1/ Levels picked from analyses by atomic absorption, all others from analyses by semiquantitative spectrographic methods.

Table 5.--Weakly or distinctly anomalous stream-sediment samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska.

Sample	Field Number	Semiquantitative spectrographic analyses										
		Mn (10)	Ag (.5)	As (200)	Be (1)	Co (5)	Cr (10)	Cu (5)	La (20)	Mo (5)	Ni (5)	Pb (10)
1	74AF051	700	N	N	L	10	50	7	70	N	10	15
2	74DB062	300	0.7	N	L	L	10	L	30	N	L	15
3	74DB056	1000	N	N	N	20	500	50	N	L	70	L
4	74DG036	1000	N	N	1.00	7	50	20	100	30	15	15
5	74DG034	700	N	N	1.00	7	30	10	N	30	5	15
6	74DG039	500	N	N	L	L	L	L	N	30	5	20
7	74DG024	1000	N	N	1.00	10	70	70	70	30	70	20
8	74DG022	700	N	N	1.00	7	30	L	150	15	5	20
9	73AF155	700	N	N	1.00	10	50	5	100	15	15	10
10	73AF131	1000	0.7	N	1.50	15	70	15	100	N	30	L
11	74DG017	700	0.50	N	1.00	15	70	70	20	7	70	L
12	74AF018	1500	N	N	1.00	15	70	70	N	5	70	10
13	74DG045	700	N	N	L	10	50	100	20	N	15	20
14	74AF015	1000	1.5	N	L	5	L	200	N	N	L	50
15	74DG008	1000	1/100.0	N	1.00	5	L	L	20	N	L	20
16	73AF115	1000	N	N	1.00	20	30	10	50	N	15	50
17	73BC292	1000	0.7	N	1.00	20	150	10	100	N	30	15
18	73AF113	700	N	N	1.00	10	20	L	30	15	5	20
19	73BC296	1000	N	N	1.00	15	70	5	100	30	10	20
20	74AF006	700	N	N	L	5	10	5	20	N	10	20
21	73AF135	1000	0.7	N	1.00	15	70	7	50	N	20	20
22	73BC304	1000	L	N	1.00	20	100	100	50	N	50	10
23	73BC305	1500	N	N	1.00	30	70	10	20	10	20	20
24	73BC272	1000	N	N	1.00	30	700	70	20	N	100	L
25	73BC273	1000	N	N	L	30	700	100	N	N	100	10
26	73BC274	1500	N	N	1.00	30	500	20	150	N	100	10
27	73BC269	1500	N	N	1.00	20	70	7	100	50	20	15
28	73BC271	1000	N	N	1.00	20	150	10	100	15	30	15
29	73DB132	1000	N	N	1.00	30	500	15	50	N	150	10
30	73DB131	1000	N	N	1.00	50	1000	5	L	N	1000	L
31	73DB128	700	1.0	N	1.00	20	200	50	70	N	100	10
32	73DB127	1000	N	N	1.00	20	500	20	50	N	100	10
33	73DG209	1000	N	N	1.00	50	2000	5	20	N	1500	L
34	73DB097	1000	N	N	1.00	30	300	5	20	N	200	10
35	73DB211	1500	N	N	1.00	30	700	10	30	N	150	10
36	73AF091	700	N	N	L	50	1500	100	30	N	1000	10
37	73DB079	1500	N	N	L	30	500	50	30	N	150	L
38	73DB080	1500	N	N	L	30	500	30	30	N	150	L
39	73DB073	1000	N	N	1.00	15	200	15	70	N	50	10
40	73DB110	1000	N	N	1.00	20	100	7	100	N	30	10
41	73DB116	1000	N	N	1.00	15	70	5	70	15	20	10
42	73DB105	1000	N	N	1.00	15	50	L	100	10	10	10
43	73AF080	1000	0.5	N	1.00	15	100	10	50	10	20	10
44	73DG198	1000	N	N	L	20	30	100	20	N	20	L
45	73DG197	1500	N	N	1.00	30	30	100	20	N	20	10
46	73AF078	1000	N	N	1.00	20	100	10	20	10	30	L
47	73DG196	5000	N	N	L	30	50	20	20	N	30	10
48	73AF075	700	0.7	N	1.50	20	100	30	30	7	30	10
49	73AF076	1000	N	N	1.00	30	150	30	20	10	50	10
50	73DB090	700	0.7	N	1.00	20	150	50	30	7	50	10
51	73DB091	1000	0.7	N	1.00	20	150	50	30	10	50	10
52	73DB092	700	1.5	N	1.00	20	100	50	50	5	50	L
53	73DB087	700	1.0	N	1.00	20	200	10	50	N	50	L
54	73AF057	2000	N	N	1.00	50	500	50	50	N	150	10
55	73DB152	700	0.5	N	1.00	10	150	15	20	10	20	L
56	73AF073	1000	L	700	1.00	20	150	20	20	N	30	10
57	74DB111	1500	N	N	1.00	15	50	20	N	N	30	L
58	73DB041	2000	N	N	1.00	30	500	20	L	N	100	10
59	73DB044	1000	L	N	1.00	20	100	150	20	N	50	10
60	73DB039	1000	N	N	L	50	70	50	L	N	30	10
61	73DG129	1500	N	N	1.00	20	300	20	20	N	50	10
62	73DG124	1500	0.5	N	1.00	20	500	20	20	N	50	15
63	73BC204	1000	N	N	1.00	30	150	10	20	N	100	15
64	73DG123	1000	N	N	1.00	20	150	70	20	7	50	10
65	73DG136	700	N	N	1.50	15	70	10	70	N	30	50

1/ Original sample was reanalyzed when resampling in the field failed to substantiate the silver value. Reanalysis of the original sample indicates "N" silver.

2/ Spectrographic analysis indicates 500 ppm.

Table 5.--Weakly or distinctly anomalous stream-sediment samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska - Continued.

Sample	Field Number	Semiquantitative spectrographic analyses										
		Mn (10)	Ag (.5)	As (200)	Be (1)	Co (5)	Cr (10)	Cu (5)	La (20)	Mo (5)	Ni (5)	Pb (10)
66	73HB013	700	N	N	1.00	30	500	15	70	N	150	10
67	74DG238	5000	N	N	L	50	500	50	L	N	70	15
68	73DG183	1000	N	N	1.00	15	100	100	50	N	30	10
69	73DG185	1000	N	N	1.00	30	500	20	100	N	150	10
70	73HB022	3000	N	200	1.00	30	150	10	30	N	50	10
71	73DB015	1000	N	N	1.50	30	150	50	50	N	50	10
72	73DB008	700	N	N	1.00	7	20	N	30	N	L	10
73	73AF003	>5000	N	N	1.50	50	10	30	100	7	5	50
74	73AF005	5000	N	N	1.50	70	50	10	70	10	20	20
75	73AF006	5000	N	N	1.00	50	70	100	100	N	30	30
76	73DB001	1500	N	N	1.50	15	15	15	50	7	10	50
77	73DB002	1500	N	N	1.00	10	50	5	100	N	10	50
78	73DB004	700	0.5	N	1.00	10	70	10	70	5	30	10
79	73DG182	700	0.7	N	1.00	10	150	20	30	N	50	10
80	73DG181	1000	0.7	N	1.00	20	150	50	100	7	50	15
81	73AF012	3000	N	N	1.00	70	30	50	50	10	20	15
82	73AF015	100	N	N	1.00	N	20	L	30	N	5	10
83	73AF016	>5000	0.5	N	1.00	100	20	50	30	N	5	200
84	73AF017	>5000	0.5	N	1.00	100	30	70	20	N	30	100
85	73AF019	3000	N	N	1.00	70	70	70	30	7	50	50
86	73DG179	1500	5.0	N	1.50	30	30	70	100	7	50	100
87	73DG186	1000	N	N	1.00	30	500	20	100	N	150	10
88	74DB124	1500	N	N	1.00	30	700	70	200	N	150	10
89	74DB123	1000	N	N	L	50	500	70	100	N	100	L
90	74DB122	2000	N	N	1.00	50	300	70	100	N	150	10
91	74DB114	1000	0.7	N	L	30	500	70	100	N	100	10
92	74DB116	1000	N	N	1.00	50	500	70	150	N	150	10
93	74DB115	1000	N	N	1.00	30	500	70	70	N	150	L
94	74DG122	1500	L	N	L	20	150	100	30	N	70	10
95	74DB213	1000	0.5	N	L	30	150	70	30	N	70	15
96	74DG249	1000	L	N	L	20	100	30	50	N	50	15
97	74DG177	1500	N	N	L	30	150	30	L	10	20	15
98	74DG119	1500	N	N	L	15	70	30	N	N	15	15
99	74DG118	1500	L	N	0.50	15	70	30	70	10	15	20
100	74DG116	1000	1.0	N	1.00	15	150	70	L	10	70	10
101	74DG180	5000	N	N	L	20	100	30	20	N	30	15
102	74DG181	1500	0.5	N	L	100	150	200	20	N	50	10
103	74DG182	1000	N	N	L	30	150	100	N	N	20	L
104	74AF112	1000	L	N	L	30	200	70	20	5	70	10
105	74AF111	1500	L	N	L	50	150	50	70	N	50	L
106	74AF107	1500	N	N	L	50	100	70	N	N	20	10
107	74AF106	1000	N	N	L	50	700	100	N	N	50	10
108	74AF109	1500	N	N	L	50	300	70	30	N	50	15
109	74DG109	1000	N	N	L	20	100	150	N	N	50	L
110	74DG103	500	0.5	N	L	15	100	50	N	N	20	50
111	74DG104	1000	N	N	L	20	100	150	30	N	50	15
112	74DG097	1000	N	N	L	15	100	100	N	N	20	L
113	74DG099	700	L	N	L	15	50	100	N	N	15	10
114	74DG223	3000	L	N	L	30	100	70	N	N	50	70
115	74DG220	5000	N	N	L	30	50	70	N	N	15	L
116	74DG217	700	0.5	N	L	20	30	70	L	5	30	10
117	74DG113	700	L	N	L	20	100	70	L	L	70	15
118	73AF026	2000	L	N	1.50	20	70	10	30	N	30	20
119	73AF024	2000	0.5	N	1.00	20	30	20	20	L	30	30
120	73BC220	1000	N	N	1.00	30	500	30	20	N	100	10
121	73BC217	1000	N	N	L	20	500	20	30	N	100	L
122	73DG111	1000	2.0	N	1.00	15	150	5	70	N	20	10
123	73BC242	1000	N	N	L	50	2000	5	20	N	1000	L
124	73BC241	1000	N	N	1.00	30	1000	10	100	N	1000	10
125	73DG147	1000	2.0	N	1.00	15	70	10	100	N	30	10

1/ Spectrographic analysis indicates 300 ppm.

Table 5.--Weakly or distinctly anomalous stream-sediment samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska - Continued

Sample	Semiquantitative spectrographic analyses - Continued						Atomic Absorption				
	Sc (5)	Sn (10)	Sr (100)	V (10)	Y (10)	Zr (10)	Au (.1)	Cu (5)	Hg (.02)	Pb (5)	Zn (10)
1	15	N	500	150	30	1000	0.20	15	0.02	5	20
2	5	N	200	30	15	150	N	5	L	5	20
3	30	N	300	150	10	30	N	55	L	10	55
4	15	N	300	100	50	300	N	20	0.02	5	40
5	10	N	300	100	15	70	N	20	0.02	5	50
6	5	N	300	20	L	30	N	L	0.02	5	35
7	15	N	200	70	30	150	N	50	0.02	20	80
8	10	N	200	70	30	150	N	5	L	15	45
9	15	N	500	150	30	200	N	10	0.02	5	35
10	20	N	500	200	50	300	N	30	N	10	45
11	15	N	300	200	30	150	N	85	0.10	10	220
12	15	N	300	200	30	200	N	100	0.04	5	65
13	15	N	700	70	15	30	N	15	0.02	5	20
14	15	N	500	70	15	200	L	L	0.10	5	40
15	15	N	700	100	30	150	N	L	0.02	5	50
16	15	N	500	150	20	150	N	20	0.04	25	90
17	20	N	1000	100	50	150	N	30	N	40	40
18	10	N	300	70	15	100	N	10	0.04	10	40
19	20	N	500	200	30	200	N	15	0.02	10	70
20	15	N	500	70	10	150	0.60	10	0.12	15	90
21	20	N	500	150	30	200	N	25	N	10	40
22	15	N	300	150	20	100	N	30	0.02	10	65
23	20	N	300	200	30	50	N	25	0.04	20	95
24	20	N	300	200	20	100	N	70	0.02	10	40
25	20	N	200	150	20	70	N	50	0.02	5	35
26	20	N	500	200	30	300	N	40	N	10	30
27	20	N	700	150	50	200	N	15	N	10	40
28	20	N	500	200	20	150	N	15	0.02	10	25
29	20	N	700	150	30	200	N	40	0.02	10	40
30	20	N	200	150	20	30	N	20	N	10	20
31	20	N	500	150	30	200	N	25	0.04	5	20
32	50	N	500	200	30	300	N	30	N	5	30
33	10	N	200	100	15	50	N	15	N	15	45
34	20	N	300	150	20	100	N	20	0.02	5	40
35	20	N	300	150	30	100	N	45	0.04	10	40
36	15	N	700	100	20	70	N	70	0.12	10	65
37	50	N	200	300	30	150	N	30	0.07	L	15
38	50	N	200	300	30	300	N	35	0.07	L	15
39	20	10	300	300	50	1000	N	30	N	10	15
40	20	N	700	200	50	1000	N	20	N	5	10
41	20	N	500	150	30	300	N	20	N	5	30
42	20	N	500	150	20	150	N	10	N	5	25
43	20	N	300	200	30	100	N	30	0.08	10	75
44	30	N	150	200	20	50	N	110	0.20	10	80
45	20	N	150	150	30	20	N	110	0.12	15	160
46	30	N	200	200	30	150	N	30	0.02	5	35
47	20	N	700	200	70	70	N	55	0.06	15	240
48	20	N	200	150	30	150	N	45	0.06	15	120
49	30	N	200	150	10	100	N	50	0.06	10	65
50	20	N	150	200	20	150	N	90	0.16	10	230
51	20	L	150	200	30	70	N	80	0.08	10	160
52	20	N	200	200	30	100	N	80	0.08	10	120
53	20	N	500	150	30	100	N	35	0.06	10	55
54	30	10	700	150	30	150	N	45	0.06	10	75
55	10	N	150	100	20	50	N	75	0.40	10	40
56	30	N	200	150	30	200	N	45	N	5	50
57	30	N	150	150	20	70	N	25	0.30	10	60
58	30	N	300	300	20	100	N	30	0.02	20	35
59	30	N	200	200	30	100	N	35	0.02	10	40
60	30	L	200	300	20	150	N	120	0.04	15	130
61	30	15	200	200	10	200	N	55	N	5	55
62	30	N	300	200	30	150	N	45	0.06	10	65
63	30	N	300	200	30	1000	0.30	50	N	10	50
64	20	10	500	150	20	100	N	65	0.02	15	70
65	20	N	300	150	20	200	N	40	0.04	45	210

Table 6.--Weakly to distinctly anomalous stream-sediment samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska--Continued.

Sample	Semiquantitative spectrographic analyses--Continued						Atomic Absorption				
	Sc (5)	Sn (10)	Sr (100)	V (10)	Y (10)	Zr (10)	Au (.1)	Cu (5)	Hg (002)	Pb (5)	Zn (10)
66	20	N	500	200	30	200	N	20	0.04	10	30
67	30	N	300	150	20	70	N	35	0.60	10	55
68	15	N	200	150	20	100	N	40	0.04	10	80
69	20	N	500	200	20	200	N	30	0.06	10	40
70	20	N	500	150	20	300	N	20	0.04	10	60
71	30	N	500	200	30	100	N	120	0.06	15	65
72	20	10	300	200	20	500	N	L	0.45	5	10
73	15	N	300	100	30	200	N	20	0.24	50	120
74	15	N	300	200	30	150	N	20	0.26	30	80
75	20	N	300	200	30	150	N	85	0.10	35	100
76	10	N	150	100	30	200	N	50	0.12	40	40
77	15	50	300	300	50	500	N	10	0.12	40	25
78	15	N	300	150	20	150	0.15	35	0.04	10	100
79	10	N	500	200	20	100	N	45	0.06	15	130
80	20	N	150	200	30	150	N	70	0.24	20	150
81	20	N	200	200	30	50	B	75	0.08	15	60
82	20	N	200	150	30	70	0.40	10	0.04	5	30
83	20	N	200	150	30	50	B	30	0.18	220	550
84	30	N	200	200	20	50	N	65	0.10	50	130
85	20	N	150	200	30	100	N	50	0.20	30	110
86	15	N	200	300	50	150	N	95	0.20	40	400
87	20	N	700	150	20	100	N	50	0.04	10	45
88	70	N	1000	150	70	150	N	70	0.04	10	45
89	50	N	300	150	30	150	N	80	0.08	15	50
90	30	N	700	150	30	150	N	70	0.10	15	55
91	50	N	1000	150	70	150	N	70	0.04	10	35
92	30	N	700	150	50	150	N	35	0.04	5	45
93	30	N	700	150	30	150	N	55	0.04	10	45
94	30	N	150	200	30	70	N	110	0.10	10	75
95	50	N	500	300	20	150	N	30	0.06	10	240
96	30	N	300	150	50	100	N	40	0.45	10	210
97	70	N	700	500	50	150	N	45	0.02	5	120
98	70	N	700	300	60	70	N	50	0.04	5	60
99	30	N	700	500	70	150	N	20	0.04	15	3/140
100	20	N	150	150	50	70	N	60	0.06	20	100
101	30	N	500	500	50	150	N	40	0.02	10	3/120
102	70	N	300	500	20	50	N	200	0.06	5	60
103	50	N	300	500	15	50	N	100	0.04	10	95
104	50	N	500	500	70	100	N	110	0.02	10	140
105	70	N	500	300	50	70	N	50	0.40	10	65
106	70	N	500	500	30	70	N	85	0.04	10	75
107	70	N	300	500	20	50	N	230	0.02	5	40
108	70	N	700	500	70	100	N	55	0.08	10	55
109	30	N	150	200	30	50	N	190	N	10	65
110	20	N	200	100	15	50	N	55	0.02	20	100
111	50	N	300	200	30	100	N	50	0.06	10	65
112	20	N	200	150	20	70	N	50	0.02	10	65
113	50	N	100	150	15	50	0.10	120	0.02	10	90
114	50	N	100	200	20	50	L	75	0.80	40	270
115	50	N	700	700	30	50	0.70	100	0.28	10	120
116	15	N	100	150	30	70	0.30	100	0.40	10	280
117	30	N	150	150	30	100	0.10	60	0.04	15	140
118	15	N	200	100	15	150	0.40	25	0.10	15	85
119	20	N	200	150	20	100	N	50	0.04	40	240
120	30	N	200	200	30	50	N	45	0.04	5	50
121	30	N	200	200	30	150	N	45	0.02	L	60
122	70	N	300	150	30	200	N	20	N	L	25
123	20	N	150	100	20	150	N	20	0.02	10	40
124	20	N	200	150	20	70	N	25	0.02	20	50
125	20	N	500	200	30	300	N	20	N	L	25

Table 5.--Weakly or distinctly anomalous stream-sediment samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska - Continued.

Sample	Field Number	Semiquantitative spectrographic analyses										
		Mn (10)	Ag (.5)	As (200)	Be (1)	Co (5)	Cr (10)	Cu (5)	La (20)	Mo (5)	Ni (5)	Pb (10)
126	73BC223	2000	2.0	N	1.00	30	70	100	50	10	15	15
127	73BC246	1500	1.0	N	1.00	15	150	20	30	N	30	15
128	73BC247	1000	N	N	1.50	15	70	5	30	7	15	20
129	73AF029	1000	N	500	1.50	20	50	15	30	N	20	15
130	73AF032	2000	N	300	1.00	30	100	15	50	N	50	20
131	73DG161	1500	N	N	1.00	20	150	20	100	7	30	100
4/132	73DG163	>5000	N	4/2000	4/30.00	30	20	5	L	10	30	4/ 10
133	73DG171	1000	N	N	1.00	20	100	20	20	N	30	10
134	74DG086	1000	N	N	L	20	70	150	N	N	20	10
135	73DG169	1000	N	N	L	20	150	10	L	N	30	10
136	73AF048	1000	N	N	1.00	15	20	5	30	20	5	15
137	73AF042	1000	N	N	1.00	15	50	L	100	N	10	10
138	73BC260	1000	N	N	1.00	15	50	L	150	N	10	15

4/ Initial analysis also indicated 2000 ppm tungsten. Original sample was reanalyzed when resampling in field failed to substantiate the analysis. The second analysis of the original sample indicates "N" arsenic, 2 ppm Be, 50 ppm Pb, and "N" tungsten; all others remain essentially unchanged.

Table 5.--Weakly or distinctly anomalous stream-sediment samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska - Continued.

Sample	Semiquantitative spectrographic analyses - Continued						Atomic Absorption				
	Sc (5)	Sn (10)	Sr (100)	V (10)	Y (10)	Zr (10)	Au (.1)	Cu (5)	Hg (002)	Pb (5)	Zn (10)
126	50	N	300	200	50	500	N	10	N	15	90
127	20	L	500	200	30	200	N	35	0.04	15	50
128	20	10	150	200	30	500	N	20	0.04	10	50
129	10	N	200	100	15	70	N	30	0.20	15	55
130	20	N	150	150	20	70	N	45	0.08	25	190
131	20	20	300	150	50	200	L	60	N	30	60
132	15	N	500	30	15	50	N	50	N	15	60
133	20	N	200	200	20	100	0.10	65	N	10	60
134	50	N	200	200	30	70	N	110	N	5	55
135	30	N	300	200	20	70	N	50	N	100	35
136	20	N	500	200	30	500	N	15	N	5	30
137	30	10	500	150	30	100	N	15	N	5	30
138	30	10	500	150	50	200	N	10	N	5	20

The levels of weakly and distinctly anomalous values for each element were determined by a combination of criteria. The levels were initially set by identifying an analytical class boundary between the 95th and 98th percentile levels on the histogram if possible. The initial levels were then modified by 1) comparison with the normal geochemical abundance of the elements in various rock types (Levinson, 1974) and 2) inspecting the histograms for natural breaks (bimodal distributions) and for "tailing out" to the highest values. This process was intended to avoid either 1) selecting a statistically normal high level from essentially nonmineralized samples or 2) selecting an extremely high level from a heavily mineralized area. Only one anomalous level was identified for some elements (table 4) because the above process did not produce a distinctly anomalous level. Elements not shown in tables 4 or 5 were not included in the geochemical interpretation because they were either not pertinent or because of the lack of results above the instrumental detection limits.

The definition of anomalous threshold levels for rock geochemical samples is more complicated and difficult than for stream-sediment samples. Samples from a given bedrock unit reflect the overall composition of the unit and that composition may differ markedly from other rock units. Thus, a certain value for a given element may be anomalously high in a sample from one rock unit, but would be only average in another rock unit. Because of this variation in the background level from unit to unit, it is necessary to treat and interpret the elemental abundance pattern for each rock unit separately. This was done for each of the 13 rock units shown on plate 1. The data were manipulated as described above for the stream-sediment samples, except that for the bedrock samples the entire process was repeated 13 times.

The next step in the bedrock geochemical analysis was to combine some of the 13 map units into larger "bedrock geochemical units." This was done because 1) many of the map units had too few samples to be statistically meaningful and 2) comparison of histograms and statistical measures indicated that some map units were similar geochemically. The variability of samples within some map units is much larger than the variability between geologically similar map units. Therefore, based on statistical comparison of the 13 map units for each analyzed element and visual comparison of the histograms for each element, the 13 units were combined into four "bedrock geochemical units" which are referred to as "schist," "gneiss," "granitic," and "ultramafic." The relations between these bedrock geochemical units and the map units shown on plate 1 are given in table 6.

TABLE 6 NEAR HERE.

A single anomalous level was then defined for each element in each of the bedrock geochemical units; these threshold levels (table 7) were

TABLE 7 NEAR HERE.

determined by the process described above for stream sediment samples. As with the stream sediments, not all elements are included. Table 8 contains the analytical data for 262 bedrock geochemical samples which

TABLES 8 AND 9 NEAR HERE.

meet or exceed the threshold anomalous level in one or more elements. Descriptions of these same bedrock samples are given in table 9 and the sample locations are plotted and identified by sample number on plate 2.

Following these manipulations, distribution patterns of important elements were analyzed to determine their economic significance, if any: these interpretations are given below.

Table 6.--Relations between "bedrock geochemical units" and geologic map units shown on plate 1

Geologic map units shown on plate 1	Bedrock geochemical units			
	Schist	Gneiss	Granitic	Ultramafic
Hornblende-biotite granodiorite (Tegr)			X	
Migmatite associated with Tertiary granodiorite (Temg)		X		
Biotite-quartz-feldspar gneiss in gneiss domes (TKgn)		X		
Porphyritic garnet-biotite-hornblende diorite (Kgdp)			X	
Foliated biotite-hornblende tonalite (Kgqd)			X	
Gneiss and schist of Coast Range batholithic complex (Kmgn)		X		
Marble and calc-silicate gneiss of Coast Range batholithic complex (Kmmb)		X		
Hornblende schist and amphibolite (Kmsh)	X			
Biotite schist (Kmsb)	X			
Undivided ultramafic rocks (Kuum)				X
Greenschist and greenstone (Kmgs)	X			
Phyllite and slate (Kmps)	X			
Limestone (Kmls)	X			

Table 7.--Levels of anomality for selected metals in bedrock geochemical samples as used on plate 2 and figures 10 to 23.

Element	Anomalous at (ppm) Ultramafic rocks[1/]	Granitic rocks[1/]	Gneiss unit [1/]	Schist unit[1/]
Ag	≥ 1.5	≥ 1.5	≥ 1.5	≥ 1.5
As	≥ 200	≥ 200	≥ 200	≥ 200
Be	≥ 5	≥ 5	≥ 5	≥ 5
Bi	≥ 10	≥ 10	≥ 10	≥ 10
Co	≥ 300	≥ 100	≥ 100	≥ 100
Cr	≥ 5000	≥ 300	≥ 1500	≥ 1500
Mo	≥ 15	≥ 15	≥ 30	≥ 50
Ni	≥ 3000	≥ 70	≥ 300	≥ 300
Sn	≥ 15	≥ 15	≥ 15	≥ 15
W	≥ 70	≥ 70	≥ 70	≥ 70
Au[2/]	≥ 0.05	≥ 0.05	≥ 0.05	≥ 0.05
Cu[2/]	≥ 1000	≥ 100	≥ 300	≥ 300
Hg[2/]	≥ 0.1	≥ 0.1	≥ 0.1	≥ 0.15
Pb[2/]	≥ 50	≥ 30	≥ 30	≥ 50
Zn[2/]	≥ 200	≥ 200	≥ 200	≥ 300

1/ See p. for correlation of these geochemical units with the lithologic units used elsewhere in this report.

2/ Analyses by atomic absorption, all other by semi-quantitative spectrographic method.

Table 8.—Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska. Values in ppm, except where indicated otherwise. Lower limits of detection are as follows: Fe: 0.05%, Mg: 0.02%, Ca: 0.05%, Ti: 0.002%, Mn: 10, Ag: 0.5, As: 200, Au: 10, B: 10, Ba: 20, Be: 1, Bi: 10, Cd: 20, Co: 5, Cr: 10, Cu: 5, La: 20, Mo: 5, Nb: 20, Ni: 5, Pb: 10, Sb: 100, Sc: 5, Sn: 10, Sr: 100, V: 10, W: 50, Y: 10, Zn: 200, Zr: 10, AA-Au: 0.05, Inst-Hg: 0.02, AA-CU: 5, AA-Pb: 5, AA-Zn: 5. Abbreviations used in the last column identify the "bedrock geochemical unit" containing the sample as follows: UM=ultramafic, SH=schist, GR=granite, GN=gneiss.

Map #	Field #	Fe %	Mg %	Ca %	Ti %	Mn	Ag	As	Au
R 1	75RF095A	10.0	3.00	10.00	0.300	1500	N	N	N
R 1	75RF095B	7.0	3.00	7.00	0.700	1500	N	N	N
R 2	75DB074A	10.0	5.00	7.00	0.700	1500	N	N	N
R 2	75DB074B	7.0	3.00	7.00	0.700	1500	N	N	N
R 2	75DB074C	15.0	3.00	7.00	1.000	2000	L	N	N
R 3	75DG074C	7.0	7.00	7.00	0.200	2000	N	N	N
R 4	75BJ032B	7.0	3.00	5.00	0.700	1500	N	N	N
R 5	75BJ026D	5.0	1.00	5.00	1.000	1000	1.5	N	N
R 6	75DB194A	3.0	1.50	5.00	0.150	1000	N	N	N
R 7	74MF057A	7.0	3.00	5.00	0.500	1500	N	N	N
R 9	[illegible]	10.0	2.00	7.00	0.700	1500	N	N	N
R 9	75DJ041A	2.0	1.50	7.00	0.200	700	N	N	N
R 10	75DJ006A	3.0	1.00	1.50	0.200	700	N	N	N
R 11	75DG151A	10.0	>10.00	0.05	0.002	700	N	N	N
R 12	75DB063B	10.0	>10.00	0.05	0.005	1000	N	N	N
R 12	75DB063C	5.0	>10.00	20.00	0.070	1000	N	N	N
R 13	75BJ094Z	10.0	>10.00	2.00	0.050	1000	N	N	N
R 14	75DB065D	20.0	7.00	7.00	0.100	1500	5.0	N	N
R 15	75DB046A	7.0	3.00	5.00	0.700	1000	N	N	N
R 16	75CH082A	3.0	1.00	1.50	0.200	500	N	N	N
R 17	75DB072C	20.0	3.00	10.00	0.150	1500	7.0	N	N
R 18	75DC048A	1.5	0.30	1.00	0.070	700	N	N	N
R 19	75DB059A	5.0	2.00	0.70	0.300	1500	N	N	N
R 20	75DC017A	5.0	2.00	2.00	0.500	700	L	N	N
R 21	75PF040A	5.0	1.50	1.50	0.300	700	N	N	N
R 22	75DD049C	1.5	0.70	2.00	0.150	500	0.5	N	N
R 23	74DB096B	0.3	0.02	0.15	0.020	70	0.5	N	N
R 24	74DB094A	3.0	0.70	1.00	0.150	700	N	N	N
R 25	75BJ044A	7.0	10.00	20.00	0.150	1500	N	N	N
R 26	75CH069A	20.0	2.00	5.00	0.010	1500	10.0	N	N
R 27	75DG004A	3.0	1.50	1.00	0.500	1000	N	N	N
R 27	75DG004B	2.0	0.50	1.00	0.150	500	N	N	N
R 27	75DG004D	5.0	1.50	1.00	0.300	500	N	N	N
R 28	75DB127A	7.0	2.00	5.00	0.700	1000	2.0	N	N
R 28	75DB127B	1.0	0.50	5.00	0.100	200	N	N	N
R 28	75DB127D	0.2	>10.00	>20.00	0.020	300	N	N	N
R 29	75DG002A	3.0	0.70	1.50	0.150	700	N	N	N
R 29	75DG002B	5.0	1.50	2.00	0.500	700	N	N	N
R 30	75DB027A	1.5	0.70	1.00	0.150	700	3.0	N	N
R 31	75CH016B	0.7	0.10	2.00	0.020	50	L	N	N
R 32	74DG364A	7.0	2.00	7.00	0.500	1000	N	N	N
R 33	74CH235C	7.0	5.00	5.00	>1.000	1000	N	N	N
R 34	75CH044C	5.0	1.50	3.00	0.300	1500	2.0	N	N
R 35	74CH221C	3.0	1.50	3.00	0.200	700	N	N	N
R 36	74CH220A	7.0	1.50	3.00	0.300	1000	N	N	N
R 36	74CH220B	7.0	3.00	5.00	0.700	1000	N	N	N
R 37	74CC149A	7.0	2.00	3.00	0.700	1500	N	N	N
R 38	74CC149B	10.0	3.00	5.00	0.700	1500	N	N	N
R 39	[illegible]	[illegible]	2.00	3.00	0.500	[illegible]	N	N	N
R 40	[illegible]	[illegible]	[illegible]	1.50	0.500	1000	N	N	N

Table 8--Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska--Cont.

map #	B	Ba	Be	Bi	Cd	Co	Cr	Cu	La	Mo
R 1	100	100	N	N	N	150	700	100	N	N
R 1	L	50	N	N	N	50	70	150	N	N
R 2	L	150	N	N	N	50	300	70	N	N
R 2	10	200	N	N	N	50	L	300	N	N
R 2	15	150	N	N	N	50	L	300	N	N
R 3	L	2000	1.0	N	N	50	1500	30	N	N
R 4	10	1500	1.0	N	N	30	200	30	20	N
R 5	L	2000	2.0	N	N	20	20	7	150	N
R 6	L	2000	1.5	N	N	5	L	L	20	N
R 7	N	1500	L	N	N	15	10	L	N	N
R 8	L	1500	1.0	N	N	20	100	7	50	N
R 9	N	>5000	L	100	N	5	300	50	20	50
R 10	N	1500	5.0	N	N	5	L	7	200	N
R 11	L	L	N	N	N	100	5000	N	N	N
R 12	L	L	N	N	N	150	>5000	L	N	N
R 12	L	L	N	N	N	30	5000	L	N	N
R 13	10	L	N	N	N	150	3000	30	N	N
R 14	50	L	N	N	N	20	L	700	N	N
R 15	L	1500	1.0	N	N	15	50	15	20	70
R 16	10	1000	1.0	N	N	15	70	10	30	N
R 17	70	100	L	N	N	150	70	1000	N	N
R 18	N	1000	5.0	N	N	5	L	L	N	N
R 19	50	1000	1.5	N	N	20	150	50	70	N
R 20	L	500	L	N	N	20	150	100	30	N
R 21	10	200	1.5	N	N	20	150	30	70	N
R 22	L	>5000	L	N	N	N	100	30	50	30
R 23	N	200	1.0	N	N	N	N	L	N	N
R 24	N	1500	L	N	N	L	N	20	N	300
R 25	L	70	N	N	N	50	700	5	N	N
R 26	70	100	L	N	N	70	L	1000	N	N
R 27	L	700	1.0	N	N	15	100	20	70	N
R 27	10	700	1.0	N	N	5	50	15	20	N
R 27	L	2000	2.0	N	N	7	150	30	100	N
R 28	L	3000	1.5	N	N	5	200	70	100	N
R 28	N	500	1.0	N	N	5	300	10	L	30
R 28	20	3000	N	N	N	N	L	N	N	N
R 29	L	1000	1.0	N	N	7	L	L	30	N
R 29	L	1500	1.0	N	N	20	70	20	50	N
R 30	10	1000	1.5	N	N	L	L	L	20	N
R 31	L	>5000	5.0	N	N	L	L	30	N	5
R 32	N	>5000	N	N	N	30	200	30	N	N
R 33	N	300	L	N	N	70	300	30	N	N
R 34	10	1500	L	N	N	15	L	50	L	N
R 35	L	700	1.0	N	N	10	100	100	20	50
R 36	N	1500	L	N	N	20	50	15	30	N
R 36	N	700	L	N	N	30	200	15	20	N
R 37	L	1500	L	N	N	50	30	70	N	N
R 38	N	700	N	N	N	70	1000	15	N	N
R 39	N	1500	1.5	N	N	50	300	20	20	N
R 40	N	1000	1.0	N	N	15	30	70	30	N

Table 8.—Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska—Cont.

map #	Nb	Ni	Pb	Sb	Sc	Sn	Sr	V	W	Y
R 1	N	200	N	N	70	N	100	200	N	30
R 1	N	70	N	N	70	N	100	300	N	30
R 2	N	100	L	N	50	N	100	300	N	30
R 2	N	50	10	N	50	N	100	300	N	50
R 2	N	15	20	N	70	N	L	500	N	70
R 3	N	150	15	N	50	N	700	200	N	20
R 4	N	70	50	N	30	N	1500	200	N	30
R 5	L	15	30	N	15	N	2000	150	N	30
R 6	N	5	50	N	10	N	1000	100	N	15
R 7	N	5	20	N	20	N	700	150	N	30
R 8	20	70	15	N	30	N	1000	200	N	100
R 9	N	50	10	N	15	N	300	2000	N	70
R 10	L	L	30	N	5	N	100	20	N	50
R 11	N	2000	N	N	N	N	N	10	N	L
R 12	N	2000	N	N	5	N	N	10	N	N
R 12	N	200	N	N	100	N	N	150	N	N
R 13	N	3000	N	N	15	N	N	30	N	N
R 14	N	5	N	N	N	N	N	70	N	L
R 15	N	7	20	N	15	N	700	150	N	20
R 16	N	20	30	N	10	N	200	70	N	10
R 17	N	200	N	N	10	N	100	150	N	20
R 18	L	N	50	N	10	N	100	15	N	70
R 19	N	70	50	N	15	N	100	150	N	20
R 20	N	70	10	N	15	N	100	100	N	20
R 21	N	70	20	N	15	N	100	100	N	30
R 22	N	15	15	N	7	N	100	500	N	20
R 23	L	L	70	N	N	N	N	15	N	30
R 24	N	L	50	N	7	N	500	30	N	10
R 25	N	100	N	N	70	N	150	200	N	10
R 26	N	20	N	N	L	N	N	50	100	10
R 27	L	20	30	N	15	N	200	150	N	30
R 27	N	7	30	N	7	N	200	50	N	15
R 27	L	7	30	N	20	N	300	150	N	70
R 28	20	30	50	N	50	N	200	150	N	50
R 28	N	70	10	N	5	N	200	500	N	50
R 28	N	5	L	N	N	N	300	70	N	L
R 29	N	L	30	N	7	N	700	70	N	15
R 29	L	20	10	N	15	N	700	150	N	20
R 30	N	L	30	N	7	N	500	50	N	10
R 31	20	10	30	N	L	N	300	70	N	30
R 32	N	70	L	N	30	N	300	150	N	20
R 33	N	70	10	N	70	N	300	300	N	30
R 34	N	10	200	N	15	N	300	150	N	20
R 35	N	20	L	N	20	N	200	700	N	70
R 36	N	20	10	N	30	N	300	150	N	50
R 36	N	70	15	N	30	N	300	200	N	70
R 37	N	70	L	N	30	N	700	200	N	20
R 38	N	300	L	N	50	N	200	150	N	10
R 39	N	100	10	N	30	N	700	150	N	20
R 40	N	100	N	N	30	N	150	200	N	30

Table 8.—Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm–Fords Terror Wilderness Study Area, Alaska—Cont.

map #	Zn	Ba	AA-Au	Inst-Hg	AA-Cu	AA-Pb	AA-Zn	Bedrock Geologic Unit
R 1	N	70	N	0.02	55	10	10	GR
R 1	N	70	N	0.02	120	5	5	GR
R 2	N	70	N	0.12	80	5	10	GN
R 2	N	100	N	0.04	460	L	15	GN
R 2	N	150	N	0.04	310	15	10	GN
R 3	N	20	N	L	20	5	10	GN
R 4	N	50	N	L	20	5	35	GR
R 5	N	200	N	0.02	L	5	30	GN
R 6	N	100	1.00	L	L	L	30	GR
R 7	N	50	N	0.10	L	5	35	GN
R 8	N	10	N	0.32	L	5	35	GR
R 9	N	150	N	0.02	25	5	15	GN
R 10	N	200	N	0.02	5	5	40	GN
R 11	N	N	N	0.02	L	25	20	UM
R 12	N	N	N	0.04	L	20	20	UM
R 12	N	N	N	0.02	L	L	L	UM
R 13	N	N	N	N	15	20	45	GN
R 14	L	N	N	0.06	410	L	5	GN
R 15	N	70	N	0.06	5	L	25	GN
R 16	N	300	N	0.10	15	10	45	GR
R 17	300	20	N	0.04	870	10	55	GN
R 18	N	100	N	0.04	N	5	25	GR
R 19	N	150	N	0.12	45	10	45	GN
R 20	N	150	N	0.04	95	15	65	GR
R 21	N	200	N	0.02	15	10	30	GR
R 22	L	70	N	0.02	20	5	35	GN
R 23	N	100	N	0.02	L	45	20	GR
R 24	N	70	N	N	40	10	65	GR
R 25	N	10	N	L	L	L	20	GR
R 26	N	L	N	0.06	1100	5	70	GN
R 27	N	150	N	0.18	20	5	60	GN
R 27	N	150	N	0.12	15	L	30	GN
R 27	N	150	N	0.14	30	5	85	GN
R 28	N	200	N	0.04	45	30	100	GN
R 28	N	100	N	0.02	20	15	30	GN
R 28	N	10	N	0.02	10	50H	15	GN
R 29	N	100	N	0.18	N	L	40	GR
R 29	N	150	N	0.18	L	L	5	GR
R 30	N	100	N	0.04	N	5	45	GR
R 31	N	30	N	0.04	35	5	L	GN
R 32	N	70	N	N	25	15H	25	GF
R 33	N	50	N	0.02	25	10	40	GR
R 34	300	150	N	0.04	50	130	230	GN
R 35	N	100	N	0.02	80	10	35	GN
R 36	N	200	N	0.16	10	10	40	GN
R 36	N	200	N	0.12	10	5	20	GN
R 37	N	30	N	0.02	25	L	20	GR
R 38	N	70	N	L	15	5	40	GR
R 39	N	100	N	0.04	20	5	35	GR
R 40	300	30	N	0.06	110	15	390	GR

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Table 8.—Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska—Cont.

MAP #	FIELD No.	Fe%	Mg%	Ca%	Ti%	Mn	Ag	As	Au
R 40	74CN183F	3.0	1.50	0.50	0.300	200	N	N	N
R 41	74CC151C	0.2	0.70	>20.00	0.020	30	N	N	N
R 42	74CN248A	3.0	0.70	1.50	0.150	300	N	N	N
R 43	74CN249B	7.0	3.00	3.00	0.700	1000	N	N	N
R 43	74CN249C	10.0	3.00	2.00	0.700	700	N	N	N
R 44	74CN251A	10.0	2.00	0.30	0.500	500	10.0	N	N
R 45	74DB390B	3.0	1.50	0.70	0.500	500	1.5	N	N
R 46	74DB437A	0.2	5.00	>20.00	0.030	150	N	N	N
R 47	74DB396B	10.0	1.00	7.00	0.030	1500	1.0	N	N
R 48	74DB397A	0.2	>10.00	20.00	0.030	100	N	N	N
R 49	74WU344B	5.0	1.00	0.50	0.700	500	N	N	N
R 50	74WU019B	7.0	2.00	2.00	0.700	700	N	N	N
R 50	74WU019C	0.5	0.03	0.15	0.030	200	N	N	N
R 51	74CC220A	2.0	0.70	1.50	0.150	500	N	N	N
R 52	74DG331A	5.0	1.50	3.00	0.200	1000	N	N	N
R 53	74CN207A	5.0	1.50	3.00	0.200	700	N	N	N
R 54	74CN210A	1.5	0.70	0.30	0.200	700	N	N	N
R 55	74CC171A	0.5	0.50	1.50	0.150	70	L	N	N
R 56	74WU292B	15.0	7.00	10.00	1.000	1500	N	N	N
R 57	74WU291E	15.0	7.00	10.00	1.000	1500	N	N	N
R 58	74DB355A	0.5	7.00	20.00	0.020	150	N	N	N
R 59	74DB354C	0.2	1.50	>20.00	0.015	50	N	N	N
R 60	74DB345B	5.0	2.00	1.00	0.700	500	N	N	N
R 61	74DB344D	5.0	1.50	1.00	0.500	500	N	N	N
R 62	74DB347D	3.0	1.50	1.00	0.500	300	N	N	N
R 63	74WU248A	3.0	3.00	1.50	0.500	700	N	N	N
R 64	74DB369D	10.0	2.00	15.00	0.100	1500	N	N	N
R 65	74DB370A	7.0	3.00	5.00	0.500	>5000	N	N	N
R 65	74DB370D	7.0	7.00	3.00	0.300	1500	N	N	N
R 66	74DB373F	7.0	7.00	0.70	0.005	1000	N	N	N
R 67	74DB308B	7.0	3.00	5.00	0.300	1500	N	N	N
R 68	74CC118A	3.0	1.00	1.50	0.300	200	N	N	N
R 69	74CC154A	7.0	3.00	2.00	0.500	1000	N	N	N
R 70	74DG322A	3.0	5.00	10.00	0.100	700	N	N	N
R 71	74CN189A	0.7	0.50	1.50	0.150	70	L	N	N
R 72	74DG312A	3.0	0.70	0.50	0.150	300	N	N	N
R 73	74CN201A	7.0	0.30	7.00	0.700	700	N	N	N
R 73	74CN201B	5.0	2.00	1.50	0.200	500	N	N	N
R 74	74CC161B	7.0	2.00	3.00	0.300	2000	N	N	N
R 74	74CC161C	7.0	3.00	5.00	0.500	1500	N	N	N
R 75	73DB232A	10.0	3.00	7.00	>1.000	1500	N	N	N
R 76	74DG329C	5.0	2.00	1.00	0.500	1000	N	N	N
R 77	74DB415A	5.0	3.00	7.00	0.200	1500	N	N	N
R 78	74DG390A	5.0	1.00	0.05	0.200	100	2.0	N	N
R 79	74DB333B	7.0	1.00	1.50	0.100	200	N	N	N
R 80	74DB332C	2.0	0.50	0.05	0.150	30	15.0	N	N
R 81	73AF285B	3.0	0.70	0.30	0.150	200	10.0	N	N
R 82	73DG378B	3.0	0.50	0.20	0.150	100	2.0	N	N
R 83	73BC400A	5.0	2.00	2.00	0.500	700	0.7	N	N
R 84	73BC398A	5.0	7.00	3.00	1.000	2000	N	N	N

Table 8.—Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska—Cont.

Map #	B	Ba	Be	Bi	Cd	Co	Cr	Cu	La	Mo
40	N	1500	L	N	N	5	300	50	20	N
41	N	N	N	N	N	N	L	N	N	N
42	N	1500	1.0	N	N	5	L	L	100	N
43	N	200	N	N	N	70	1000	15	20	N
43	N	700	L	N	N	50	300	150	30	N
44	N	2000	1.5	N	N	7	200	70	150	N
45	L	>5000	1.5	N	N	5	150	30	50	N
46	N	20	N	N	N	N	L	N	N	N
47	30	70	L	N	N	10	L	150	L	N
48	N	N	N	N	N	N	L	L	N	N
49	L	1500	2.0	N	N	20	300	50	[illegible]	N
50	N	1000	L	N	N	15	100	20	70	N
50	L	300	1.0	N	N	L	L	L	N	70
51	N	1500	1.5	N	N	5	L	N	20	N
52	N	1500	L	N	N	7	20	L	L	N
53	N	1500	1.0	N	N	10	L	5	100	N
54	N	1000	L	N	N	5	20	L	20	N
55	N	>5000	L	N	N	5	100	30	N	N
56	L	100	N	N	N	70	1500	70	N	N
57	N	200	L	N	N	70	1000	100	L	N
58	N	N	N	N	N	L	L	L	N	N
59	N	300	L	N	N	N	L	5	N	N
60	15	1000	1.0	N	N	5	300	50	100	30
61	N	1500	L	N	N	15	300	100	100	[illegible]
62	L	1500	2.0	N	N	7	50	20	L	50
63	N	500	L	N	N	20	700	30	N	N
64	N	N	L	N	N	10	L	L	L	N
65	N	1000	L	N	N	20	300	15	20	[illegible]
65	N	30	N	N	N	70	1000	10	N	N
66	N	10	N	N	N	70	7000	20	N	N
67	L	1000	L	N	N	30	50	150	N	L
68	N	1500	1.5	N	N	10	150	50	N	N
69	N	700	L	N	N	70	1000	50	N	N
70	N	70	N	N	N	20	1500	L	N	N
71	N	[illegible]	L	N	N	5	150	30	N	[illegible]
72	L	2000	L	N	N	5	20	L	70	N
73	N	100	1.0	N	N	20	200	20	100	N
73	N	300	L	N	N	10	150	15	50	N
74	L	700	1.0	N	N	50	700	7	N	N
74	L	500	L	N	N	50	1000	N	N	N
75	10	150	1.0	N	N	100	50	50	70	N
76	N	3000	L	N	N	20	200	L	300	N
77	L	1500	1.0	N	N	15	20	L	30	N
78	15	5000	1.0	N	N	5	L	50	30	N
79	N	500	N	N	N	5	200	100	L	50
80	15	>5000	1.5	N	N	5	L	100	L	N
81	L	500	L	20	N	N	N	5000	L	N
82	10	1500	1.0	N	30	10	20	150	L	[illegible]
83	L	1000	1.0	N	N	20	30	100	L	N
84	N	20	1.0	N	N	30	1000	10	N	N

Table 8.—Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska--Cont.

Map No.	Nb	Ni	Pb	Sb	Sc	Sn	Sr	V	W	Y
R 40	N	30	L	N	20	N	200	200	N	[illegible]
R 41	N	N	N	N	N	N	700	L	N	10
42	N	5	10	N	5	N	500	30	N	L
R 43	L	100	10	N	30	N	300	150	N	[illegible]
R 43	20	30	L	N	30	N	500	150	N	30
R 44	N	7	30	N	30	N	150	150	N	[illegible]
R 45	N	5	20	N	15	N	200	150	N	10
R 46	N	N	N	N	N	N	1500	L	N	N
R 47	N	L	N	N	N	N	N	30	N	N
R 48	N	N	N	N	N	N	N	L	N	N
R 49	L	30	10	N	30	N	100	100	N	50
R 50	L	50	10	N	15	N	700	150	N	30
R 50	N	5	30	N	L	N	N	10	N	N
R 51	N	5	15	N	5	N	500	50	N	L
R 52	N	5	10	N	15	N	500	100	N	30
R 53	N	5	10	N	15	N	700	100	N	[illegible]
R 54	L	10	L	N	5	N	N	20	N	[illegible]
R 55	N	100	N	N	7	N	L	200	N	[illegible]
R 56	20	200	N	N	70	N	150	200	N	[illegible]
R 57	L	300	N	N	50	N	100	200	N	[illegible]
R 58	N	L	N	N	N	N	150	10	N	[illegible]
R 59	N	L	N	N	N	N	100	15	N	L
R 60	N	20	50	N	50	N	200	150	N	70
R 61	N	50	15	N	20	N	150	150	N	[illegible]
R 62	N	15	L	N	20	N	100	100	N	[illegible]
R 63	N	500	N	N	70	N	L	150	N	[illegible]
R 64	N	10	N	N	N	N	N	70	N	[illegible]
R 65	L	100	L	N	30	N	700	150	N	[illegible]
R 65	N	300	L	N	30	N	200	100	N	15
R 66	N	3000	N	N	7	N	N	50	N	N
R 67	N	30	10	N	50	N	200	300	N	[illegible]
R 68	N	50	L	N	15	N	300	200	N	20
R 69	N	300	N	N	30	N	200	150	N	15
R 70	N	150	L	N	30	N	150	100	N	10
R 71	N	20	N	N	7	N	150	1500	N	30
R 72	N	5	20	N	5	N	300	20	N	10
R 73	L	50	20	N	30	N	500	150	N	50
R 73	N	15	30	N	20	N	300	100	N	15
R 74	N	200	L	N	30	N	200	200	N	[illegible]
R 74	N	300	L	N	30	N	200	200	N	15
R 75	50	50	10	N	50	N	30	300	N	50
R 76	N	50	30	N	30	N	200	100	N	100
R 77	N	L	10	N	15	N	1500	100	N	[illegible]
R 78	N	L	300	N	30	N	N	[illegible]	N	[illegible]
R 79	N	30	50	N	15	N	200	300	N	10
R 80	N	5	1000	N	15	N	N	20	N	[illegible]
R 81	N	5	15	N	7	N	100	30	N	10
R 82	N	200	15	N	10	N	N	1000	N	[illegible]
R 83	L	50	15	N	20	N	200	500	N	50
R 84	N	1000	10	N	30	N	200	150	N	[illegible]

Table 8.—Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska—Cont.

Map No.	Zn	Zr	AA-Au	Inst-Hg	AA-Cu	AA-Pb	AA-Zn	Bedrock Geochem Unit
R 40	L	100	N	0.02	35	10	100	GR
R 41	N	N	N	0.02	10	30H	15	GN
R 42	N	100	N	0.40	L	10	35	GR
R 43	N	100	N	0.06	10	10	30	GR
R 43	N	150	0.10	0.04	120	10	70	GN
R 44	N	100	N	0.06	55	10	60	GN
R 45	N	150	N	N	30	10	35	GN
R 46	N	L	N	L	5	30	L	GN
R 47	100	10	N	0.04	460	10	50	GN
R 48	N	L	N	L	5	30	L	GN
R 49	N	200	N	0.02	30	10	65	GR
R 50	L	100	N	0.28	25	15	50	GR
R 51	N	300	N	N	N	10	5	GR
R 51	N	100	0.10	0.04	N	5	40	GR
R 52	N	150	N	0.12	15	10	70	GR
R 53	N	70	N	0.14	L	5	30	GR
R 54	N	200	N	0.06	N	30	15	GN
R 55	200	70	N	0.06	40	10	270	GN
R 56	N	150	N	L	25	L	5	GN
R 57	N	150	N	L	80	5	10	GN
R 58	N	N	N	L	10	30H	5	GN
R 59	N	N	N	N	10	30H	5	GN
R 60	N	200	N	0.02	45	5	60	GN
R 61	N	150	N	N	55	5	170	GN
R 62	N	100	N	L	30	5	50	GN
R 63	N	30	N	L	20	10	45	GN
R 64	200	50	N	L	L	5	15	GN
R 65	N	100	N	L	15	5	40	GN
R 65	N	70	N	N	10	10	50	GN
R 66	N	N	N	N	15	L	5	GN
R 67	500	70	N	0.02	190	5	370	GN
R 68	300	100	N	0.06	65	10	210	GN
R 69	N	50	N	N	30	5	30	GN
R 70	N	10	N	0.04	15	10	10	GN
R 71	N	70	N	0.02	35	5	190	GN
R 72	N	50	N	0.10	15	5	50	GR
R 73	N	200	N	0.14	10	15	50	GN
R 73	N	100	N	0.14	15	10	40	GN
R 74	N	20	N	0.02	5	L	5	GN
R 74	N	20	N	0.02	L	5	40	GN
R 75	N	200	N	N	10	5	25	GN
R 76	N	100	N	0.22	15	10	75	GN
R 77	N	100	N	0.02	10	150	95	GR
R 78	N	200	N	0.02	55	250	10	SH
R 79	300	20	N	0.02	130	55	170	SH
R 80	N	100	N	0.30	100	1500	30	SH
R 81	N	50	0.20	0.55	5700	10	25	SH
R 82	2300	50	N	N	85	15	1600	SH
R 83	500	150	N	N	50	10	350	SH
R 84	N	150	N	N	5	L	10	SH

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Table 8.--Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska--Cont.

Map no.	Field No.	Fe %	Mg %	Ca %	Ti %	Mn	Ag	As	Au
R 85	73DG397A	5.0	3.00	3.00	0.500	1500	N	N	N
R 86	73DG394A	5.0	2.00	2.00	0.500	1000	N	N	N
R 87	73BC404A	3.0	2.00	3.00	0.500	700	2.0	N	N
R 88	74CC139G	1.0	3.00	5.00	0.070	150	N	N	N
R 89	74CC138A	5.0	1.50	2.00	0.500	700	N	N	N
R 90	73AF271A	3.0	7.00	3.00	0.050	700	N	N	N
R 90	73AF271B	7.0	10.00	0.20	0.005	1000	N	N	N
R 91	73DB239A	5.0	10.00	2.00	0.100	1000	N	N	N
R 91	73DB239B	7.0	10.00	0.15	0.002	1000	N	N	N
R 91	73DB239C	5.0	10.00	0.30	0.020	1000	N	N	N
R 91	73DB239D	3.0	10.00	5.00	0.050	500	0.5	N	N
R 91	73DB239E	5.0	10.00	0.07	0.010	700	N	N	N
R 92	74DB447C	7.0	>10.00	0.15	0.020	700	N	N	N
R 93	74DB446B	7.0	>10.00	1.50	0.100	1500	N	N	N
R 93	74DB446C	2.0	>10.00	10.00	0.070	1000	N	N	N
R 93	74DB446E	2.0	7.00	10.00	0.070	300	N	N	N
R 94	74DG314A	1.5	0.70	1.00	0.150	300	N	N	N
R 95	74DG319A	1.5	0.30	0.50	0.070	300	N	N	N
R 96	74DG318C	1.0	0.30	0.70	0.070	300	N	N	N
R 97	74DG317B	7.0	7.00	3.00	0.150	1500	N	N	N
R 98	74DG315A	3.0	7.00	0.20	0.015	700	N	N	N
R 99	73AF281A	3.0	1.50	1.50	0.500	1000	N	N	N
R 100	73DB242B	3.0	10.00	7.00	0.030	1000	N	N	N
R 100	73DB242C	3.0	10.00	7.00	0.030	1000	N	N	N
R 100	73DB242E	3.0	10.00	1.00	0.020	700	N	N	N
R 101	73DG406B	5.0	10.00	1.00	0.020	1000	N	N	N
R 101	73DG406A	3.0	5.00	10.00	0.050	700	N	N	N
R 102	73DG407B	5.0	10.00	0.05	0.010	700	N	N	N
R 103	73DB247A	3.0	5.00	7.00	0.150	700	N	N	N
R 104	74DG346A	5.0	3.00	5.00	0.300	1000	N	N	N
R 105	74WU256A	7.0	>10.00	0.05	0.010	1000	N	N	N
R 106	74AF154A	5.0	1.00	3.00	0.300	500	N	N	N
R 107	74DG349A	1.0	0.20	0.70	0.150	700	N	N	N
R 108	74DG350A	2.0	0.70	1.50	0.150	500	N	N	N
R 109	74DG351B	20.0	5.00	5.00	1.000	1500	L	N	N
R 109	74DG351C	10.0	3.00	15.00	0.700	1000	N	N	N
R 110	74DG360B	10.0	7.00	7.00	>1.000	1500	N	N	N
R 111	74DB340D	5.0	1.50	2.00	0.500	700	20.0	N	N
R 112	74CN193B	2.0	0.50	0.20	0.100	1500	N	N	N
R 113	74AF237A	5.0	3.00	5.00	0.150	1000	N	N	N
R 114	74AF236A	1.5	0.30	0.50	0.150	200	N	N	N
R 115	74AF235A	10.0	2.00	2.00	0.300	700	N	N	N
R 116	74CC099B	7.0	3.00	5.00	0.500	1000	N	N	N
R 117	74CN149B	10.0	3.00	3.00	0.500	1500	N	N	N
R 118	74CN236B	0.7	0.10	0.30	0.020	70	N	N	N
R 119	74CN168D	15.0	3.00	3.00	0.700	500	N	N	N
R 120	74DB408B	7.0	>10.00	5.00	0.150	1500	N	N	N
R 121	74DB406B	5.0	3.00	7.00	0.200	1500	N	N	N
R 121	74DB406C	7.0	3.00	5.00	0.150	1500	N	N	N
R 122	74WU251C	7.0	3.00	3.00	0.500	1000	N	N	N

Table 8.--Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska--Cont.

Map No.	B	Ba	Be	Bi	Cd	Co	Cr	Cu	La	Mo
R 85	L	1500	1.5	N	N	20	30	10	50	N
R 86	L	1500	1.0	N	N	20	20	10	70	20
R 87	L	1000	1.0	N	N	15	15	20	L	N
R 88	30	500	200.0	N	N	5	L	5	L	N
R 89	L	700	1.0	N	N	20	20	30	N	N
R 90	N	L	N	N	N	50	5000	L	N	N
R 90	N	L	N	N	N	200	>5000	20	N	N
R 91	L	L	L	N	N	100	>5000	10	N	N
R 91	L	L	N	N	N	200	>5000	20	N	N
R 91	L	150	N	N	N	150	>5000	L	N	N
R 91	L	L	N	N	N	100	>5000	5	N	N
R 91	L	L	N	N	N	150	>5000	L	N	N
R 92	L	20	N	N	N	100	>5000	L	N	N
R 93	L	20	N	N	N	100	>5000	50	N	N
R 93	N	20	N	N	N	30	1500	30	N	N
R 93	N	20	N	N	N	15	1500	30	N	N
R 94	N	1500	L	N	N	L	20	L	20	N
R 95	L	700	L	N	N	5	L	L	150	N
R 96	N	1000	L	N	N	5	L	L	L	N
R 97	N	1000	L	N	N	70	2000	7	N	N
R 98	N	N	N	N	N	70	1500	20	N	N
R 99	N	1500	1.0	N	N	10	N	10	70	15
R 100	L	L	L	N	N	30	5000	5	N	N
R 100	L	L	L	N	N	30	5000	L	N	N
R 100	L	20	N	N	N	100	>5000	10	N	N
R 101	N	L	N	N	N	100	3000	50	N	N
R 101	L	L	N	N	N	20	200	10	N	N
R 102	N	L	N	N	N	100	5000	L	N	N
R 103	L	100	L	N	N	50	1500	10	L	N
R 104	N	700	1.0	N	N	15	70	15	N	N
R 105	N	30	N	N	N	100	5000	L	N	N
R 106	N	3000	L	N	N	5	L	7	L	N
R 107	N	1500	1.0	N	N	5	L	N	70	N
R 108	N	500	1.0	N	N	5	L	L	30	N
R 109	N	300	N	N	N	100	50	300	N	N
R 109	N	700	L	N	N	30	30	30	70	N
R 110	N	70	L	N	N	100	1500	7	N	N
R 111	N	700	1.0	N	N	30	150	150	N	N
R 112	L	150	L	N	N	5	L	70	L	N
R 113	N	300	1.0	N	N	50	300	20	N	N
R 114	L	1500	2.0	N	N	5	20	5	20	N
R 115	N	2000	L	N	N	50	200	30	100	N
R 116	N	500	N	N	N	50	700	50	L	N
R 117	N	700	L	N	N	70	700	15	N	N
R 118	N	1000	5.0	N	N	70	20	5	N	10
R 119	N	150	N	N	N	100	100	150	20	N
R 120	L	300	N	N	N	70	1500	L	N	N
R 121	L	500	L	N	N	20	L	70	N	100
R 121	L	200	L	N	N	30	L	150	N	N
R 122	N	500	L	N	N	70	1000	30	N	N

Table 8.—Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska—Cont.

Map No.	Nb	Ni	Pb	Sb	Sc	Sn	Sr	V	W	Y
R 85	L	7	30	N	30	N	700	150	N	20
R 86	L	5	15	N	20	N	700	150	N	20
R 87	L	5	10	N	15	N	500	150	N	15
R 88	N	5	20	N	N	20	150	10	N	10
R 89	N	10	15	N	30	N	700	150	N	20
R 90	N	1000	N	N	30	N	N	70	N	L
R 90	N	5000	N	N	10	N	N	50	N	N
R 91	N	3000	L	N	20	N	N	100	N	15
R 91	N	3000	N	N	10	N	N	30	N	N
R 91	N	2000	N	N	10	N	N	50	N	N
R 91	N	2000	N	N	10	N	L	70	N	N
R 91	N	3000	N	N	10	N	N	30	N	N
R 92	N	1500	N	N	10	N	N	70	N	N
R 93	N	500	N	N	30	N	N	70	N	N
R 93	N	100	N	N	10	N	150	50	N	N
R 93	N	100	N	N	30	N	200	70	N	N
R 94	N	L	30	N	5	N	200	15	N	20
R 95	N	5	20	N	L	N	N	L	N	15
R 96	N	L	20	N	5	N	200	L	N	10
R 97	N	300	L	N	30	N	100	100	N	15
R 98	N	1000	N	N	7	N	N	30	N	L
R 99	L	L	10	N	20	N	500	150	N	30
R 100	N	2000	L	N	10	N	N	50	N	N
R 100	N	2000	L	N	7	N	N	50	N	15
R 100	N	3000	N	N	10	N	N	50	N	N
R 101	N	3000	10	N	7	N	N	20	N	N
R 101	N	300	L	N	5	N	100	20	N	N
R 102	N	3000	N	N	7	N	N	20	N	N
R 103	N	200	L	N	30	N	200	150	N	10
R 104	N	10	300	N	20	N	700	150	N	15
R 105	N	2000	N	N	7	N	N	30	N	L
R 106	L	L	20	N	5	N	500	70	N	15
R 107	N	L	10	N	N	N	200	L	N	10
R 108	N	L	L	N	N	N	300	10	N	10
R 109	N	50	N	N	70	N	150	300	N	50
R 109	N	15	L	N	30	N	1500	200	N	30
R 110	L	1000	N	N	30	N	100	150	N	15
R 111	N	50	10	N	30	N	300	150	N	15
R 112	N	20	N	N	5	N	L	100	N	10
R 113	L	70	10	N	30	N	150	100	N	15
R 114	N	5	10	N	5	N	200	10	N	10
R 115	N	70	20	N	30	N	500	150	N	30
R 116	N	30	L	N	50	N	300	150	N	15
R 117	N	150	N	N	50	N	300	200	N	15
R 118	N	L	N	N	N	N	N	10	N	L
R 119	N	50	N	N	100	N	500	500	N	10
R 120	N	200	N	N	15	N	N	70	N	N
R 121	N	5	10	N	30	N	300	150	N	20
R 121	N	10	L	N	20	N	200	150	N	30
R 122	N	300	N	N	30	N	200	150	N	20

Table 8.—Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska—Cont.

Map No.	Zn	Zr	AA-Au	Inst-Hg	AA-Cu	AA-Pb	AA-Zn	Bedrock Geochem Unit
R 85	N	50	N	N	10	50	55	GR
R 86	N	70	N	N	5	10	65	GR
R 87	N	150	N	N	10	10	55	GR
R 88	N	150	N	0.02	10	10	25	GN
R 89	N	100	N	0.10	25	5	30	GR
R 90	N	N	N	N	L	5	5	UM
R 90	N	N	N	N	10	25	20	UM
R 91	N	N	N	N	10	5	10	UM
R 91	N	N	N	N	L	20	25	UM
R 91	N	N	N	N	L	15	25	UM
R 91	N	20	N	N	L	10	10	UM
R 91	N	N	N	N	L	20	20	UM
R 92	N	N	N	L	N	15	15	UM
R 93	N	20	N	0.02	40	15	30	UM
R 93	N	10	N	0.02	30	L	L	GN
R 93	N	10	N	0.02	30	5	L	GN
R 94	N	150	0.10	0.04	15	L	30	GN
R 95	N	100	N	0.04	15	30	35	GR
R 96	N	50	N	0.04	20	95	35	GN
R 97	N	30	N	0.02	15	5	45	GN
R 98	N	10	N	0.02	45	L	20	GN
R 99	200	150	N	N	L	5	30	GR
R 100	N	N	N	N	5	L	5	UM
R 100	N	N	N	N	N	N	5	UM
R 100	N	L	N	N	10	20	30	UM
R 101	N	N	N	N	45	50	20	UM
R 101	N	N	N	N	10	10	5	GN
R 102	N	N	N	N	L	15	10	UM
R 103	N	10	N	0.02	15	15	5	GN
R 104	N	100	N	0.06	15	230	400	GR
R 105	N	N	N	N	L	10	10	UM
R 106	N	200	N	0.14	5	5	35	GR
R 107	N	50	N	0.12	15	10	30	GR
R 108	N	150	N	0.12	15	10	45	GR
R 109	N	50	N	0.12	300	15	55	GN
R 109	N	150	N	0.16	40	15	40	GN
R 110	N	150	N	0.08	20	5	20	GN
R 111	N	70	N	L	70	5	65	GN
R 112	N	50	N	0.02	75	60	70	GN
R 113	N	30	N	0.02	L	45	20	GN
R 114	N	150	N	0.02	35	50	15	GN
R 115	N	100	N	0.04	15	400	55	GN
R 116	N	70	N	N	30	5	L	GR
R 117	N	30	N	N	20	L	40	GR
R 118	N	10	N	0.04	N	L	5	GN
R 119	N	10	N	N	95	5	25	GN
R 120	L	20	N	0.02	N	10	65	GN
R 121	N	70	N	N	85	5	30	GN
R 121	N	50	N	N	300	5	15	GN
R 122	N	50	N	0.02	25	10	30	GN

Table 8.--Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska--Cont.

Map No.	Field No.	Fe%	Mg%	Ca%	Ti%	Mn	Ag	As	Au
R 123	74DB222C	7.0	1.50	3.00	0.300	1500	L	N	N
R 124	74CN151D	3.0	1.00	5.00	0.200	700	N	N	N
R 125	74CN152B	7.0	3.00	3.00	0.500	1500	N	N	N
R 126	74CN153C	5.0	1.00	0.50	0.500	300	N	N	N
R 127	74CN093A	15.0	7.00	10.00	0.500	1500	N	N	N
R 128	74CN088A	10.0	3.00	7.00	0.500	1500	N	N	N
R 128	74CN088C	5.0	0.70	2.00	0.200	700	7.0	N	N
R 129	74DG232A	1.5	1.00	2.00	0.200	200	0.7	N	N
R 130	74CC062C	L	0.10	7.00	0.005	20	N	N	N
R 131	74WV165A	0.1	0.70	20.00	0.010	100	N	N	N
R 132	74CC093C	3.0	1.00	1.50	0.300	700	N	N	N
R 133	74CN138E	10.0	1.50	5.00	0.700	2000	N	N	N
R 134	74CC091A	7.0	1.50	3.00	0.700	700	N	N	N
R 134	74CC091C	15.0	3.00	3.00	0.700	700	N	N	N
R 135	74WV200A	3.0	0.70	5.00	0.150	700	N	N	N
R 136	74AF200A	3.0	0.70	2.00	0.150	700	N	N	N
R 137	74AF201A	3.0	0.70	2.00	0.150	500	N	N	N
R 138	74DB274B	7.0	>10.00	0.30	0.005	1500	N	N	N
R 139	73DB220A	5.0	3.00	2.00	0.500	700	1.0	N	N
R 140	73DB222F	3.0	2.00	10.00	0.200	1000	N	N	N
R 141	73DG387A	7.0	3.00	1.50	0.500	1500	N	N	N
R 142	73DG389A	7.0	2.00	0.50	0.500	500	1.0	N	N
R 143	73AF256A	2.0	0.70	L	0.150	100	1.5	N	N
R 144	73AF254D	3.0	2.00	2.00	0.300	1000	0.5	N	N
R 145	74DB296C	7.0	10.00	10.00	0.300	3000	N	N	N
R 146	74DB297E	7.0	>10.00	10.00	0.150	1500	N	N	N
R 147	74AF251A	20.0	7.00	7.00	1.000	1000	N	N	N
R 147	74AF251B	15.0	7.00	15.00	>1.000	1500	N	N	N
R 148	73BC254A	3.0	5.00	5.00	0.700	700	N	N	N
R 149	73BC258A	3.0	3.00	3.00	1.000	700	N	N	N
R 150	73BC336B	3.0	3.00	2.00	0.300	700	3.0	N	N
R 150	73BC336C	0.3	0.20	7.00	0.020	700	N	N	N
R 151	73DG275A	0.3	0.50	N	0.200	30	0.7	N	N
R 152	74AF233A	3.0	1.50	2.00	0.300	500	2.0	N	N
R 153	74DB324C	5.0	1.00	1.50	0.300	1000	0.5	N	N
R 154	74CC087G	10.0	2.00	0.50	0.150	1500	0.5	N	N
R 155	74CC086B	7.0	2.00	2.00	0.500	1500	N	N	N
R 156	74DB322B	10.0	3.00	0.10	0.150	1000	0.5	N	N
R 157	74DG301B	5.0	2.00	0.70	0.150	500	N	N	N
R 157	74DG301D	7.0	2.00	7.00	0.200	1500	0.5	N	N
R 158	74CN130B	3.0	0.70	0.30	0.100	150	N	N	N
R 159	74CN133C	7.0	1.50	3.00	0.500	500	N	N	N
R 160	74CN082A	15.0	10.00	10.00	1.000	1000	N	N	N
R 161	74AF066A	7.0	2.00	3.00	0.500	1000	N	N	N
R 162	74AF163A	7.0	3.00	0.50	0.700	1500	N	N	N
R 163	74DB164A	3.0	7.00	>20.00	0.050	700	N	N	N
R 164	74DB162C	10.0	5.00	5.00	1.000	1500	N	N	N
R 165	74CN078C	5.0	1.00	1.00	0.300	500	N	N	N
R 166	74DG209A	5.0	2.00	2.00	0.300	1500	1.5	N	N
R 167	74CN070B	1.0	0.50	1.00	0.050	70	N	N	N

Table 8.--Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska--Cont.

Map no.	B	Ba	Be	Bi	Cd	Co	Cr	Cu	La	Mo
R 123	N	300	L	N	N	30	L	700	N	N
R 124	N	150	5.0	N	N	5	30	7	L	N
R 125	N	700	1.5	N	N	50	700	L	N	N
R 126	10	700	1.0	N	N	5	100	30	30	N
R 127	15	100	N	N	N	100	500	50	N	N
R 128	L	1000	N	N	N	30	L	15	N	N
R 128	N	>5000	1.0	N	N	L	15	L	150	N
R 129	L	>5000	1.0	N	100	7	300	70	N	30
R 130	N	N	N	N	N	5	L	L	N	N
R 131	N	50	N	N	N	N	L	N	N	N
R 132	N	1500	3.0	N	N	10	L	10	70	N
R 133	10	700	1.0	N	N	70	1000	L	N	N
R 134	N	500	2.0	N	N	30	70	7	20	N
R 134	N	700	L	N	N	70	300	50	20	N
R 135	L	500	10.0	N	N	10	20	5	30	N
R 136	N	2000	2.0	N	N	10	20	L	150	N
R 137	N	1500	2.0	N	N	7	L	L	20	N
R 138	L	L	N	N	N	100	>5000	L	N	N
R 139	10	1000	1.0	N	N	15	2000	100	20	7
R 140	L	1000	L	N	N	50	1500	30	70	N
R 141	N	50	L	N	N	30	N	70	L	N
R 142	10	3000	1.0	N	N	30	50	200	L	70
R 143	15	1000	1.0	N	N	N	N	10	30	N
R 144	L	1000	1.0	N	N	20	100	100	L	70
R 145	L	N	L	N	N	50	1500	30	N	N
R 146	[illegible]	L	N	N	N	50	1500	7	N	N
R 147	10	150	L	N	N	150	700	100	N	N
R 147	15	150	1.0	N	N	150	500	100	N	N
R 148	10	200	1.5	N	N	30	700	50	30	N
R 149	N	200	1.0	N	N	20	300	5	30	7
R 150	N	N	L	N	N	20	300	15	20	20
R 150	L	N	N	N	N	N	10	5	N	50
R 151	30	5000	1.5	L	N	N	70	5	L	50
R 152	N	700	2.0	N	N	15	100	30	50	N
R 153	10	1500	2.0	N	N	15	70	50	L	30
R 154	N	30	N	N	N	15	150	500	N	N
R 155	N	300	N	N	N	30	200	100	N	N
R 156	N	100	N	N	N	50	20	150	N	100
R 157	L	2000	1.0	N	N	L	L	70	N	N
R 157	L	>5000	N	N	N	10	10	1500	N	10
R 158	L	1000	1.0	N	N	5	20	15	N	N
R 159	N	200	N	N	N	70	1500	100	N	N
R 160	15	150	1.0	N	N	100	700	150	N	N
R 161	L	2000	N	N	N	15	30	10	N	N
R 162	N	2000	L	N	N	30	200	70	70	N
R 163	L	L	N	N	N	N	20	N	N	N
R 164	N	L	L	N	N	100	1000	L	N	N
R 165	L	500	1.0	N	N	7	30	7	20	N
R 166	L	3000	L	N	N	20	300	70	N	10
R 167	N	>5000	L	N	N	N	N	15	L	N

Table 8.—Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska—Cont.

Map no.	Nb	Ni	Pb	Sb	Sc	Sn	Sr	V	W	Y
R 123	N	5	10	N	20	N	500	200	N	30
R 124	L	30	L	N	10	N	700	70	N	20
R 125	N	300	N	N	30	N	500	150	N	30
R 126	N	5	L	N	15	N	L	100	N	15
R 127	N	150	N	N	50	N	100	200	N	15
R 128	N	N	10	N	20	N	500	150	N	30
R 128	N	L	20	N	L	N	700	15	N	L
R 129	N	70	10	N	10	N	200	1500	N	30
R 130	N	L	N	N	N	20	100	L	N	N
R 131	N	L	N	N	N	N	N	L	N	N
R 132	N	L	L	N	7	N	700	70	N	20
R 133	N	300	N	N	20	N	150	200	N	30
R 134	N	30	L	N	30	N	1000	150	N	20
R 134	N	70	N	N	50	N	150	200	N	70
R 135	N	30	N	N	10	N	500	30	N	15
R 136	N	10	20	N	10	N	700	70	N	20
R 137	N	7	10	N	15	N	700	70	N	15
R 138	N	3000	L	N	10	N	N	30	N	N
R 139	L	200	15	N	30	N	300	200	N	20
R 140	L	100	15	N	30	N	500	150	N	15
R 141	N	5	10	N	50	15	L	200	N	20
R 142	N	30	15	N	50	N	150	500	N	N
R 143	L	5	200	N	15	15	N	20	N	30
R 144	N	30	10	N	30	N	200	200	N	30
R 145	N	150	L	N	50	N	200	300	N	20
R 146	N	150	N	N	70	N	100	300	N	10
R 147	20	300	N	N	30	N	700	150	N	20
R 147	20	300	N	N	30	N	700	150	N	30
R 148	20	150	L	N	30	N	2000	200	N	20
R 149	20	100	L	N	20	N	700	150	N	20
R 150	N	50	L	N	20	N	100	150	N	15
R 150	N	5	L	N	L	N	500	10	N	L
R 151	L	5	15	N	15	N	N	2000	N	10
R 152	N	50	L	N	15	N	200	100	N	20
R 153	N	50	50	N	30	N	100	150	N	30
R 154	N	15	N	N	30	N	N	150	N	15
R 155	N	30	L	N	50	N	200	200	N	20
R 156	N	30	N	N	50	N	N	150	N	15
R 157	N	L	150	N	15	N	100	30	N	20
R 157	N	5	150	N	30	N	500	300	N	15
R 158	N	30	N	N	30	N	N	30	N	30
R 159	N	200	N	N	50	N	150	200	N	30
R 160	N	300	N	N	30	N	500	150	N	30
R 161	N	5	15	N	30	N	700	150	N	30
R 162	L	70	30	N	30	N	200	150	N	30
R 163	N	L	20	N	L	N	3000	15	N	20
R 164	N	300	L	N	50	N	150	150	N	30
R 165	N	15	10	N	7	N	L	50	N	L
R 166	N	70	30	N	30	N	200	150	N	15
R 167	N	N	70	N	N	N	500	20	N	L

Table 8.—Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm–Fords Terror Wilderness Study Area, Alaska—Cont.

Map No.	Zn	Zr	AA-Au	Inst-Hg	AA-Cu	AA-Pb	AA-Zn	Bedrock Geochem Unit
R 123	N	30	N	0.02	420	10	15	GN
R 124	N	100	N	0.02	15	10	10	GN
R 125	N	100	N	0.02	10	L	35	GN
R 126	N	150	N	0.10	35	5	40	GN
R 127	N	20	N	0.04	40	L	10	GN
R 128	N	150	N	0.10	15	L	40	GN
R 128	N	70	N	0.02	L	L	25	GN
R 129	2000	150	N	0.02	55	5	790	GN
R 130	N	10	N	N	L	L	L	SH
R 131	N	N	N	L	5	45H	L	GN
R 132	N	150	N	0.10	10	5	40	GN
R 133	N	50	N	L	15	5	50	GN
R 134	N	50	N	0.12	L	5	45	GN
R 134	300	70	N	0.10	L	10	70	GN
R 135	N	70	N	L	5	10	55	GN
R 136	N	70	N	L	5	220	50	GR
R 137	N	50	N	L	L	85	35	GR
R 138	N	L	N	0.02	L	15	30	UM
R 139	N	70	N	N	30	15	150	SH
R 140	N	50	N	0.02	55	20	60	SH
R 141	300	30	N	N	35	15	130	SH
R 142	500	30	N	N	130	15	200	SH
R 143	N	150	N	N	N	320	20	SH
R 144	N	50	N	0.04	110	5	40	SH
R 145	L	30	N	0.02	20	10	10	SH
R 146	N	20	N	N	3	L	L	SH
R 147	N	150	0.10	0.14	45	5	30	SH
R 147	N	200	0.10	0.12	50	5	30	SH
R 148	N	100	N	N	85	5	20	GR
R 149	N	150	N	N	10	5	25	GR
R 150	N	30	N	0.02	20	15	50	SH
R 150	N	10	N	0.02	5	20	10	SH
R 151	N	100	N	0.14	L	15	10	SH
R 152	N	150	N	0.04	40	10	25	SH
R 153	N	150	0.10	0.02	40	15	100	SH
R 154	N	30	N	0.08	340	5	15	SH
R 155	N	70	N	0.12	70	L	10	GR
R 156	300	20	N	0.10	140	5	30	SH
R 157	N	100	N	L	75	60	70	SH
R 157	500	20	N	L	500	180	400	SH
R 158	N	100	0.40	0.06	20	L	80	SH
R 159	N	50	N	L	120	5	35	SH
R 160	N	70	N	N	55	L	30	SH
R 161	N	70	N	0.10	10	5	35	GR
R 162	N	150	N	N	50	5	35	GR
R 163	N	30	N	0.08	5	50	20	SH
R 164	N	70	N	0.04	L	10	10	SH
R 165	N	300	[illegible]	0.75	10	L	25	SH
R 166	N	70	[illegible]	0.02	70	15	50	SH
R 167	N	20	N	L	20	[illegible]	10	GR

Table 8.—Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska—Cont.

Map no.	Field No.	Fe %	Mg %	Ca %	Ti %	Mn	Ag	As	Au
R 168	74CN072A	15.0	7.00	15.00	0.300	1000	N	N	N
R 169	74CN071B	10.0	7.00	7.00	0.300	1000	N	N	N
R 170	73DG260A	2.0	1.50	2.00	0.300	700	N	N	N
R 171	74WV186D	7.0	1.50	7.00	0.500	700	N	N	N
R 172	74DG158B	3.0	1.50	3.00	0.070	>5000	3.0	N	N
R 173	73DG265A	1.0	0.50	0.70	0.200	150	L	200	N
R 174	73DG264A	3.0	2.00	0.70	0.300	500	1.0	N	N
R 175	74AF209A	2.0	1.00	0.30	0.300	150	N	N	N
R 176	74WV181A	1.5	0.50	1.00	0.100	150	N	N	N
R 177	74DB194B	5.0	1.50	3.00	0.300	1000	N	N	N
R 178	74AF124A	10.0	2.00	5.00	1.000	2000	N	N	N
R 179	73HB002A	7.0	5.00	1.50	0.500	1000	N	N	N
R 180	73HB004A	5.0	5.00	2.00	0.200	1000	N	N	N
R 181	73HB006B	2.0	0.50	0.50	0.020	150	5.0	N	N
R 182	73HB016C	10.0	2.00	0.50	0.500	1000	1.5	N	N
R 183	73HB018A	10.0	0.10	N	0.070	10	2.0	N	N
R 184	74DG241A	7.0	>10.00	1.00	>1.000	2000	0.5	N	N
R 185	73DB016B	0.3	0.70	20.00	0.020	100	3.0	N	N
R 186	73DB013B	0.7	0.30	1.50	0.020	1000	N	N	N
R 187	73DB003A	2.0	0.70	0.07	0.200	10	1.0	N	N
R 188	73HB027B	0.7	0.50	15.00	0.020	700	1.0	N	N
R 189	74CN097C	15.0	10.00	7.00	0.500	1000	N	N	N
R 190	74CN098A	10.0	3.00	1.00	0.500	700	L	N	N
R 191	74WV158B	1.5	1.50	20.00	0.070	700	N	N	N
R 192	74DB125D	3.0	5.00	1.50	0.500	500	N	N	N
R 193	74WV043A	7.0	1.50	5.00	0.500	1500	N	N	N
R 194	74AF177D	3.0	0.10	1.00	0.100	500	N	N	N
R 195	74WV150A	1.5	1.50	5.00	0.100	1000	N	N	N
R 196	74DB218B	1.0	0.50	0.10	0.200	150	0.5	N	N
R 196	74DB218C	0.3	0.05	0.05	0.020	50	N	N	N
R 197	74WV055A	2.0	1.00	0.10	0.150	150	1.5	N	N
R 198	73DG189A	1.5	1.00	20.00	0.150	150	1.0	N	N
R 199	73DB165C	1.0	0.70	1.00	0.150	200	1.5	N	N
R 200	73DG239A	3.0	1.00	2.00	0.300	1000	N	N	N
R 201	73BL003A	5.0	2.00	0.20	0.500	700	N	N	N
R 202	73HB034B	3.0	1.50	0.30	0.200	1500	2.0	N	N
R 203	73BC331A	3.0	2.00	1.00	0.200	1000	L	N	N
R 204	73DG245A	0.3	0.50	L	0.200	700	2.0	N	N
R 205	73AF107B	7.0	2.00	0.50	1.000	150	2.0	N	N
R 206	73AF106A	3.0	3.00	1.50	0.500	500	0.7	N	N
R 207	74WV050A	7.0	1.50	5.00	0.500	1500	N	N	N
R 208	74WV052A	10.0	2.00	5.00	0.700	1500	N	N	N
R 209	74DB209B	7.0	2.00	2.00	>1.000	300	1.5	N	N
R 210	74DG196A	0.7	1.00	3.00	0.500	700	2.0	N	N
R 211	74DG173A	7.0	1.50	5.00	0.700	1500	N	N	N
R 212	74AF109C	7.0	5.00	10.00	0.700	1500	3.0	N	N
R 213	74AF108C	15.0	3.00	7.00	1.000	700	N	N	N
R 214	74AF106B	10.0	5.00	10.00	0.500	1000	N	N	N
R 214	74AF106G	10.0	3.00	10.00	0.700	1000	N	N	N
R 215	74CC010A	10.0	2.00	5.00	0.300	700	N	N	N

Table 8.--Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska--Cont.

Map No.	B	Ba	Be	Bi	Cd	Co	Cr	Cu	La	Mo
R 168	10	100	N	N	N	100	150	7	N	N
R 169	10	700	N	N	N	70	150	70	N	N
R 170	L	1500	1.0	N	N	15	20	20	L	20
R 171	15	20	5.0	N	N	20	150	5	50	N
R 172	N	1000	L	N	N	15	70	500	N	7
R 173	L	3000	L	N	N	N	N	10	100	N
R 174	10	3000	2.0	N	N	15	100	150	20	10
R 175	50	2000	1.5	N	N	5	150	30	20	N
R 176	L	700	L	N	N	5	L	10	20	50
R 177	N	300	L	N	N	15	30	15	N	N
R 178	L	1500	1.0	N	N	20	200	150	50	7
R 179	N	150	N	N	N	100	700	L	30	N
R 180	L	200	N	N	N	50	2000	70	N	N
R 181	L	1000	1.5	10	N	N	N	200	N	N
R 182	N	1500	L	N	N	100	N	500	N	N
R 183	N	700	L	N	N	7	20	20	30	10
R 184	10	>5000	1.5	N	N	50	300	5	70	15
R 185	N	30	N	N	N	N	15	N	L	5
R 186	10	150	L	N	N	N	10	L	N	N
R 187	10	3000	1.0	N	N	5	30	7	50	30
R 188	N	70	N	N	N	5	15	10	N	N
R 189	10	500	L	N	N	100	500	10	N	N
R 190	15	2000	1.0	N	N	15	20	70	30	N
R 191	N	150	L	N	N	N	30	L	N	N
R 192	N	50	L	N	N	30	1000	15	20	N
R 193	N	3000	1.5	N	N	5	10	L	50	N
R 194	N	200	7.0	N	N	5	20	L	200	N
R 195	30	2000	L	N	N	7	20	20	N	10
R 195	10	>5000	1.0	N	30	7	70	150	N	50
R 196	N	1500	N	N	N	5	L	15	N	N
R 197	15	>5000	L	N	N	N	70	20	N	L
R 198	20	1500	L	N	N	5	150	5	30	N
R 199	L	1000	1.0	N	N	N	20	L	20	20
R 200	L	2000	1.5	N	N	7	10	L	20	50
R 201	N	500	1.0	N	N	20	10	L	70	50
R 202	10	300	L	N	N	10	10	10	N	N
R 203	15	700	1.5	L	N	20	100	200	50	5
R 204	15	2000	1.5	N	N	N	30	L	20	50
R 205	10	1500	2.0	N	N	5	150	20	30	100
R 206	10	>5000	5.0	N	N	7	15	5	150	5
R 207	L	2000	1.0	N	N	5	N	L	N	100
R 208	L	3000	L	N	N	7	L	L	20	100
R 209	L	>5000	1.0	N	N	70	70	300	N	N
R 210	N	1500	L	N	N	5	10	100	20	5
R 211	N	3000	L	N	N	10	10	L	70	15
R 212	N	700	1.5	N	N	50	2000	100	L	N
R 213	20	150	L	N	N	100	15	700	N	N
R 214	N	30	N	N	N	100	200	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 8.—Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska—Cont.

Map No.	Nb	Ni	Pb	Sb	Sc	Sn	Sr	V	W	Y
R 168	N	100	L	N	50	N	150	200	N	20
R 169	N	70	L	N	50	N	200	200	N	15
R 170	N	10	15	N	10	N	500	150	N	15
R 171	N	50	10	N	20	N	700	100	N	50
R 172	N	50	N	N	5	N	100	200	N	30
R 173	L	L	50	N	5	N	300	20	N	10
R 174	20	50	10	N	15	N	150	200	N	10
R 175	N	30	10	N	20	N	L	150	N	10
R 176	N	7	10	N	5	N	300	20	N	L
R 177	N	10	10	N	20	N	500	100	N	15
R 178	30	70	15	N	50	N	300	100	N	50
R 179	20	150	L	N	50	N	300	200	N	20
R 180	N	500	N	N	30	N	L	150	N	10
R 181	L	L	200	N	N	N	100	10	N	10
R 182	N	10	L	N	50	N	L	300	N	30
R 183	N	150	15	N	5	N	N	50	N	20
R 184	30	150	300	N	30	N	200	200	N	30
R 185	N	7	L	N	N	N	500	150	N	10
R 186	N	10	10	N	L	N	150	30	N	N
R 187	N	20	15	N	10	N	N	1000	N	L
R 188	N	7	100	N	L	N	500	15	N	N
R 189	N	150	N	N	50	N	150	100	N	15
R 190	L	30	20	N	30	N	300	500	N	30
R 191	N	5	N	N	N	N	300	50	N	15
R 192	L	500	N	N	15	N	200	70	N	15
R 193	L	L	15	N	15	N	1000	150	N	30
R 194	150	L	10	N	7	N	100	L	N	70
R 195	N	50	10	N	7	N	300	200	N	15
R 196	N	70	L	N	10	N	L	3000	N	30
R 196	N	15	N	N	N	N	N	150	N	L
R 197	N	L	L	N	10	N	N	150	N	L
R 198	N	50	L	N	7	N	700	150	N	20
R 199	N	5	10	N	7	N	100	200	N	10
R 200	L	5	15	N	15	N	700	150	N	20
R 201	L	5	L	N	20	N	100	150	N	30
R 202	N	5	100	N	15	N	N	70	N	15
R 203	L	30	70	N	15	10	100	100	N	30
R 204	N	10	10	N	5	N	N	1000	N	L
R 205	30	5	100	N	30	N	100	200	N	10
R 206	30	15	150	N	7	10	200	30	N	70
R 207	L	L	15	N	10	N	1000	150	N	20
R 208	L	L	15	N	15	N	1000	150	N	30
R 209	L	70	10	N	50	L	300	300	N	30
R 210	L	L	15	N	10	N	1000	70	N	30
R 211	L	L	20	N	20	N	1500	150	N	50
R 212	N	150	10	N	100	N	500	200	N	50
R 213	N	10	N	N	>100	N	700	1000	N	20
R 214	N	150	N	N	100	N	100	150	N	L
R 214	N	100	N	N	100	N	100	200	N	L
R 215	N	100	N	N	50	N	500	150	N	[illegible]

Table 8.—Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm–Fords Terror Wilderness Study Area, Alaska—Cont.

Map No.	Zn	Zr	AA-Au	Inst-Hg	AA-Cu	AA-Pb	AA-Zn	Bedrock geochemical unit
R 168	N	50	N	L	5	L	L	GN
R 169	N	50	N	0.14	65	L	5	GN
R 170	N	100	N	N	10	5	40	GR
R 171	N	200	N	0.02	5	10	15	GN
R 172	200	50	N	0.06	220	5	50	GN
R 173	N	200	N	0.02	L	L	25	GN
R 174	700	150	N	0.02	90	10	350	GN
R 175	N	150	N	L	10	15	270	GN
R 176	N	70	N	0.02	10	L	30	GN
R 177	N	150	N	0.12	20	5	25	GN
R 178	N	150	N	0.06	85	10	65	GR
R 179	N	150	N	0.02	100	10	70	SH
R 180	N	30	N	0.02	140	15	30	SH
R 181	2000	70	N	0.90	300	350	1100	SH
R 182	N	100	N	0.02	340	10	70	SH
R 183	N	20	N	0.24	30	30	65	SH
R 184	200	100	N	0.08	L	70H	100	SH
R 185	N	10	N	N	10	40	40	SH
R 186	N	10	N	0.02	15	65	15	SH
R 187	N	70	N	0.18	15	20	130	SH
R 188	N	N	N	N	10	90	10	SH
R 189	N	70	N	L	15	L	15	SH
R 190	N	150	0.05	N	45	5	280	SH
R 191	N	20	N	0.02	5	50H	15	SH
R 192	N	70	N	N	10	L	10	SH
R 193	L	50	0.05	L	L	5	95	SH
R 194	N	>1000	N	0.04	L	15	35	SH
R 195	500	50	N	0.04	25	30	320	SH
R 196	1000	150	N	0.30	240	10	1200	SH
R 195	300	L	N	0.02	40	10	310	SH
R 197	N	70	N	0.08	20	L	L	SH
R 198	500	70	N	0.40	15	10	300	SH
R 199	N	70	N	0.06	10	5	15	SH
R 200	N	100	N	N	5	5	55	GR
R 201	N	100	N	N	5	10	85	SH
R 202	300	50	0.10	0.02	40	170	400	SH
R 203	300	150	N	N	110	50	300	SH
R 204	N	70	N	0.16	L	10	45	SH
R 205	N	150	N	N	20	75	10	SH
R 206	N	700	N	N	5	110	90	SH
R 207	L	100	N	N	L	L	25	GR
R 208	L	150	N	N	L	L	25	GR
R 209	N	100	N	0.02	190	15	50	SH
R 210	N	100	N	0.02	150	L	130	SH
R 211	N	200	N	0.02	5	5	55	GR
R 212	N	100	N	0.02	110	L	L	UM
R 213	N	20	N	0.04	1000	5	15	UM
R 214	N	10	N	0.08	2200	5	10	UM
R 214	N	15	N	0.08	1900	L	10	UM
R 215	L	20	N	0.24	150	5	30	UM

Table 8.—Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska—Cont.

Map No.	Field No.	Fe %	Mg %	Ca %	Ti %	Mn	Ag	As	Au
R 216	73DG288B	2.0	1.00	1.00	0.200	700	N	N	N
R 217	73BL006A	2.0	0.50	0.15	0.150	300	N	N	N
R 218	74DB104A	7.0	5.00	5.00	0.500	1000	N	N	N
R 219	73DB149D	0.7	0.02	0.05	0.070	70	0.5	N	N
R 220	74DG131A	7.0	1.50	3.00	>1.000	200	50.0	N	N
R 221	74CN051A	3.0	1.00	0.07	0.150	700	N	N	N
R 222	73DB145B	3.0	1.00	0.30	0.200	700	N	N	N
R 222	73DB145D	3.0	0.02	N	0.020	15	2.0	N	N
R 223	73DB170B	1.5	0.15	L	0.100	50	N	N	N
R 224	73SN010A	5.0	1.00	0.20	0.300	300	L	N	N
R 225	73AF094B	3.0	1.50	1.50	0.500	3000	L	200	N
R 226	73DG371A	3.0	0.10	0.50	0.070	150	20.0	N	N
R 227	74AF137A	1.0	1.00	20.00	0.050	1000	N	N	N
R 228	74WU121A	2.0	0.50	0.70	0.150	500	N	N	N
R 229	74WU183A	5.0	1.50	1.50	0.200	500	N	N	N
R 229	74WU183B	10.0	2.00	2.00	0.300	700	N	N	N
R 230	74AF123A	7.0	7.00	7.00	0.300	1500	N	N	N
R 231	74DB193A	15.0	7.00	0.70	0.150	1000	N	N	N
R 232	74WU190B	1.0	0.50	20.00	0.100	150	N	N	N
R 233	74DB195B	3.0	1.00	2.00	0.300	500	0.5	N	N
R 234	74DB205A	7.0	5.00	7.00	0.070	1000	N	N	N
R 234	74DB205B	20.0	1.50	2.00	0.150	700	1.5	N	N
R 235	74DB206B	10.0	1.50	15.00	0.300	3000	N	N	N
R 236	73DB216D	3.0	2.00	0.50	0.200	200	0.5	N	N
R 237	73DB212A	2.0	0.70	1.50	0.200	300	20.0	N	N
R 238	73AF158A	3.0	1.00	1.50	0.150	700	N	N	N
R 239	73DG316A	1.5	1.00	0.50	0.150	150	0.5	N	N
R 240	74AF073C	10.0	2.00	2.00	0.500	1000	L	N	N
R 241	74AF074A	15.0	5.00	5.00	0.500	1000	N	N	N
R 242	74DG136A	7.0	3.00	5.00	0.500	1500	0.7	N	N
R 243	73DB182B	2.0	0.50	0.15	0.100	700	N	N	N
R 244	73DB181B	2.0	0.50	1.00	0.150	200	N	N	N
R 245	73DB176B	3.0	3.00	5.00	0.300	1000	N	N	N
R 246	73DB179C	2.0	0.50	3.00	0.100	300	N	N	N
R 247	73DB178A	3.0	2.00	2.00	0.500	1000	N	N	N
R 248	73DB173B	5.0	3.00	7.00	0.500	1000	N	N	N
R 248	73DB173E	2.0	0.15	0.70	0.050	300	N	N	N
R 249	73DB172D	0.2	0.05	0.05	0.010	20	N	N	N
R 250	74DG134C	2.0	0.50	1.50	0.200	300	1.0	N	N
R 251	74DG133B	3.0	1.50	2.00	0.300	500	0.7	N	N
R 252	73BC360A	3.0	2.00	2.00	0.300	700	N	N	N
R 253	73SN014B	3.0	1.50	1.50	0.200	500	0.5	N	N
R 254	73BL023A	1.0	0.70	1.50	0.150	200	0.5	N	N
R 255	74DB184E	5.0	5.00	7.00	0.300	1500	N	N	N
R 256	73DG335B	3.0	3.00	1.50	0.700	2000	N	N	N
R 257	73DG340A	3.0	10.00	0.50	0.030	700	N	N	N
R 258	73SN019A	2.0	1.00	0.70	0.150	500	N	N	N
R 259	73BL016A	2.0	1.00	1.50	0.200	500	N	N	N
R 260	73BL012A	2.0	1.00	1.50	0.150	500	N	N	N
R 261	73DB197A	2.0	0.70	1.00	0.150	500	N	N	N
R 262	73BL014A	3.0	1.00	1.50	0.200	500	N	N	N

Table 8.—Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska—Cont.

Map No.	B	Ba	Be	Bi	Cd	Co	Cr	Cu	La	Mo
R 216	10	500	1.0	N	N	10	10	20	30	[illegible]
R 217	L	300	1.0	N	N	10	50	10	20	70
R 218	N	300	L	N	N	50	700	50	20	N
R 219	L	50	N	N	N	N	N	L	20	N
R 220	10	2000	L	N	N	15	50	50	100	N
R 221	L	500	30.0	N	N	10	15	5	150	L
R 222	L	300	L	N	N	5	15	50	20	N
R 222	L	20	N	N	N	N	10	1500	L	N
R 223	L	150	L	N	N	N	10	5	L	N
R 224	10	200	1.0	N	N	20	70	150	20	N
R 225	L	3000	2.0	N	N	15	100	100	50	10
R 226	L	20	1.0	N	N	N	N	10	50	N
R 227	N	L	L	N	N	L	15	L	N	N
R 228	N	700	2.0	N	N	5	10	L	70	N
R 229	L	500	L	N	N	15	L	15	20	N
R 229	L	700	N	N	N	50	100	30	N	N
R 230	L	200	L	N	N	30	3000	30	N	N
R 231	N	700	L	N	N	150	>5000	20	N	N
R 232	10	100	L	N	N	5	20	10	N	N
R 233	N	1000	1.0	N	N	7	15	70	500	N
R 234	N	L	N	N	N	30	500	L	N	N
R 234	10	L	1.0	N	[illegible]	70	[illegible]	1000	20	[illegible]
R 235	N	20	L	N	N	15	200	L	20	N
R 236	L	500	L	N	N	10	10	700	30	7
R 237	L	500	1.0	N	N	5	N	15	30	N
R 238	L	1000	L	N	N	15	50	500	20	N
R 239	L	3000	1.0	N	N	7	30	100	20	20
R 240	N	300	L	N	N	20	150	50	N	100
R 241	N	L	N	N	N	70	2000	70	N	N
R 242	N	L	L	N	N	30	70	700	N	N
R 243	L	300	L	10	N	5	N	300	20	N
R 244	L	300	1.0	L	N	5	N	100	20	30
R 245	N	50	L	10	N	50	700	200	N	N
R 246	10	500	1.0	N	N	7	15	20	30	N
R 247	L	300	1.0	N	N	20	20	15	30	20
R 248	N	700	L	N	N	30	300	7	N	50
R 248	L	300	1.0	N	N	N	N	5	20	50
R 249	L	L	L	N	N	N	N	L	20	50
R 250	N	>5000	1.5	N	50	7	100	150	N	30
R 251	N	5000	1.0	N	N	15	70	70	N	30
R 252	L	700	1.0	10	N	15	15	50	N	N
R 253	L	1500	1.0	N	N	20	10	500	50	7
R 254	10	>5000	1.5	L	N	7	100	100	20	30
R 255	N	200	L	N	N	30	2000	15	N	N
R 256	L	500	1.5	N	N	50	20	30	50	5
R 257	10	50	N	N	N	70	5000	10	N	10
R 258	L	300	1.0	N	N	7	10	10	30	50
R 259	L	2000	1.0	10	N	7	N	20	20	5
R 260	L	1000	1.0	10	N	5	N	30	30	7
R 261	L	700	1.0	10	N	5	N	100	20	N
R 262	L	1500	1.0	10	N	7	N	30	30	5

Table 8.--Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska—Cont.

Map No.	Nb	Ni	Pb	Sb	Sc	Sn	Sr	V	W	Y
R 216	L	5	30	N	15	20	300	70	N	20
R 217	L	20	20	N	10	N	100	50	N	10
R 218	L	150	L	N	30	N	200	150	N	30
R 219	N	5	20	N	N	N	N	15	N	10
R 220	50	15	10	N	30	N	300	150	N	50
R 221	70	15	10	N	7	10	L	70	N	70
R 222	N	5	10	N	15	N	100	100	N	20
R 222	N	5	50	N	L	N	L	10	N	N
R 223	N	5	N	N	L	N	N	20	N	L
R 224	L	50	15	N	10	N	100	70	N	10
R 225	20	70	15	N	20	N	200	500	N	50
R 226	N	5	L	N	7	N	L	10	N	50
R 227	N	L	70	N	L	N	1000	10	N	10
R 228	L	5	50	N	5	15	150	30	N	30
R 229	N	5	10	N	15	N	300	100	N	15
R 229	N	30	15	N	30	N	500	150	N	15
R 230	N	1000	L	N	20	N	200	100	N	10
R 231	N	1500	L	N	10	N	L	70	N	N
R 232	N	L	N	N	5	N	1000	15	N	10
R 233	L	L	30	N	15	20	500	20	N	30
R 234	N	100	L	N	50	L	200	150	N	L
R 234	N	70	L	N	15	L	100	70	70	15
R 235	N	70	70	N	30	L	100	100	N	50
R 236	L	7	10	N	15	N	150	100	N	10
R 237	N	5	10	N	5	N	500	50	N	L
R 238	N	30	L	N	15	N	150	100	N	20
R 239	N	30	15	N	10	N	100	300	N	10
R 240	N	70	L	N	50	N	200	200	N	50
R 241	N	500	10	N	70	N	150	200	N	30
R 242	N	50	L	N	50	N	100	200	N	30
R 243	N	5	20	N	7	L	N	10	N	15
R 244	N	L	10	N	10	N	150	30	N	20
R 245	N	100	10	N	30	N	150	200	N	15
R 246	L	10	10	N	7	N	500	30	N	20
R 247	N	15	10	N	20	N	700	150	N	15
R 248	N	30	10	N	50	N	500	300	N	20
R 248	L	5	10	N	7	L	150	10	N	30
R 249	N	5	N	N	N	N	N	15	N	N
R 250	N	70	10	N	15	N	100	1000	N	50
R 251	N	70	15	N	20	N	200	500	N	20
R 252	L	7	20	N	15	N	700	150	N	15
R 253	N	5	20	N	7	N	500	150	N	10
R 254	N	100	20	N	7	N	300	1000	N	30
R 255	N	150	L	N	70	N	200	150	N	20
R 256	30	20	20	N	30	15	300	200	N	50
R 257	N	2000	10	N	10	N	N	70	N	N
R 258	L	10	20	N	5	N	500	50	N	10
R 259	L	L	50	N	10	N	500	70	N	15
R 260	L	5	50	N	5	N	500	30	N	10
R 261	N	5	30	N	7	N	500	50	N	10
R 262	L	5	30	N	10	N	500	70	N	10

Table 8.--Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska--Cont.

Map no.	Zn	Zr	AA-Au	Inst-Hg	AA-Cu	AA-Pb	AA-Zn	Bedrock Geochem. unit
R 216	N	100	N	0.02	20	5	25	SH
R 217	N	150	N	N	15	15	35	SH
R 218	L	70	N	0.22	45	10	30	SH
R 219	N	N	N	0.02	5	75	30	SH
R 220	L	150	N	N	15	5	65	SH
R 221	L	>1000	N	0.02	5	5	95	SH
R 222	300	100	N	0.06	35	5	400	SH
R 222	N	30	N	0.04	1300	110	100	SH
R 223	N	150	N	0.16	10	N	10	SH
R 224	N	200	0.20	N	130	10	40	SH
R 225	L	150	N	N	110	15	160	SH
R 226	N	150	N	N	L	N	10	SH
R 227	N	20	N	0.02	10	75	5	GN
R 228	N	100	N	0.02	L	5	20	SH
R 229	N	20	N	0.02	20	65	40	GR
R 229	N	30	N	0.02	25	30	30	GR
R 230	N	70	N	L	25	5	15	GN
R 231	200	10	N	L	15	20	75	UM
R 232	N	100	N	L	5	35H	10	GN
R 233	N	150	N	0.02	30	5	25	SH
R 234	N	10	N	0.04	N	15	L	GN
R 234	N	50	N	0.02	750	15	15	GN
R 235	L	100	N	0.02	N	35	10	GN
R 236	L	70	N	0.02	520	L	55	GN
R 237	N	150	N	N	L	L	30	GR
R 238	N	50	N	N	330	L	40	SH
R 239	300	50	N	0.04	55	20	650	SH
R 240	L	70	0.10	N	25	5	20	SH
R 241	L	50	N	N	60	L	10	SH
R 242	N	50	N	0.02	380	L	10	SH
R 243	500	70	N	0.02	160	L	150	GN
R 244	N	100	N	N	35	L	25	SH
R 245	N	30	N	0.02	15	N	5	GN
R 246	N	50	0.05	0.02	45	15	15	GN
R 247	N	50	N	N	15	5	45	GF
R 248	N	30	N	N	15	15	10	SH
R 248	N	100	N	0.02	15	L	40	SH
R 249	N	10	N	N	L	[illegible]	[illegible]	SH
R 250	2000	70	N	0.02	120	5	1400	SH
R 251	1000	70	N	0.02	95	5	590	SH
R 252	N	20	N	N	15	5	45	GI
R 253	N	150	N	N	470	10	45	GN
R 254	500	70	N	N	50	5	550	GN
R 255	N	30	N	0.02	5	15	40	GN
R 256	300	100	N	0.02	25	10	130	GR
R 257	N	N	N	N	5	20	55	UM
R 258	N	200	N	N	L	5	55	GN
R 259	N	70	N	N	L	L	35	GR
R 260	N	30	N	N	L	5	40	GR
R 261	N	100	N	0.02	L	L	40	GR
R 262	N	70	N	0.02	L	10	35	GR

Table 9.—Descriptions of anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska.

[Abbreviations used are as follows: AK = alaskite, AM = amphibolite, AN = andesite, AP = aplite, BG = banded gneiss, CS = calc silicate, DI = diorite, DN = dunite, GB = gabbro, GD = granodiorite, GN = gneiss, GR = granite, GS = greenstone, HB = hornblendite, IG = irregular banded gneiss, MB = marble, PD = peridotite, PH = phyllite, PX = pyroxenite, QD = quartz diorite, QM = quartz monzonite, QO = quartz monzodiorite, QZ = quartz and quartzite, SC = schist, SE = serpentinite, SI = semischist, SK = skarn, SL = slate, SW = stockwork, TO = tonalite, UM = ultramafic, UP = unclassified plutonic, ZO = zone.]

		Description				
		Rock Type	Mineralization			Other
Map No.	Field No.		Background No Visible Sulfides	FE Stain	Visible Sulfides	
R001	75AF095A	AM	X			
	75AF095B	AM	X			
R002	75DB074A	GN	X			
	75DB074B	GN		X		
	75DB074C	GN		X		ZO 1x5 m
R003	75DG072C	GN	X			
R004	75BJ032B	DI	X			
R005	75BJ026B	QD	X			
R006	75DB104A	GD	X			
R007	74AF057A	TO	X			
R008	75DG086A	DI	X			
R009	75BJ041A	BG	X			
R010	75BJ006A	QZ	X			
R011	75DG151A	PD	X			
R012	75DB063B	SE	X			
	75DB063C	PX	X			
R013	75BJ004B	UM	X			
R014	75DB065D	GB		X		Float
R015	75DB066A	DI	X			
R016	75CN020A	GN	X			
R017	75DB072C	GN			X	Float
R018	75DG048A	QM	X			
R019	75DB059A	GN	X			
R020	75CC017A	GN	X			Float
R021	75AF040A	GN	X			
R022	75DB048C	GN		X		ZO 1x5 m
R023	74DB086B	AP	X			
R024	74DB084A	GD	X			
R025	75BJ044A	GR	X			
R026	75CN060A	PR	X			
R027	75DG004A	SC	X			
	75DG004B	QM	X			
	75DG004D	SC		X		ZO 1x5 m
R028	75DB127A	GN	X			
	75DB127B	GR	X			
	75DB127D	MB		X		
R029	75DG002A	QO	X			
	75DG002B	DI	X			
R030	75DB027A	GD	X			
R031	75CN016B	QZ			X	
R032	74DG364A	QZ	X			
R033	74CN235C	GB	X			
R034	75CN044C	AN	X			
R035	74CN221C	GN		X		
R036	74CN220A	QD	X			
	74CN220B	GN	X			
R037	74CC149A	DI	X			
R038	74CC146B	GB	X			

Table 9.—Descriptions of anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska--Continued

Map No.	Field No.	Description				
		Rock Type	Mineralization			Other
			Background No Visible Sulfides	FE Stain	Visible Sulfides	
R039	74CN182A	DI	X			
R040	74CN183E	GD		X		
	74CN183F	GD		X		
R041	74CC151C	MB	X			
R042	74CN248A	GR	X			
R043	74CN249B	DI	X			
	74CN249C	GN		X		
R044	74CN251A	GN		X		
R045	74DB390B	GN		X		ZO 1 m thick
R046	74DB437A	MB	X			
R047	74DB396B	SK		X		1x5 m gossan
R048	74DB397A	MB	X			
R049	74WV344B	GN	X			
R050	74WV019B	AN	X			
	74WV019C	AP		X		
R051	74CG220A	QD	X			
R052	74DG331A	GD	X			
R053	74CN207A	TO	X			
R054	74CN210A	QZ	X			
R055	74CC171A	SL	X			
R056	74WV292B	GN		X		
R057	74WV291E	GN	X			
R058	74DB355A	MB	X			
R059	74DB354C	MB	X			
R060	74DB345B	GN		X		Altered zone
R061	74DB344D	GN		X		Wide stain ZO
R062	74DB347D	GN	X			
R063	74WV248A	GN		X	X	
R064	74DB369D	SK		X		
R065	74DB370A	GN	X			
	74DB370D	HB	X			
R066	74DB373F	SE	X			
R067	74DB308B	GN		X		ZO 2 m thick
R068	74CC110A	GN	X			
R069	74CC154A	MB	X			
R070	74DG322A	SC	X			
R071	74CN189A	PH	X			
R072	74DG312A	QM				
R073	74CN201A	GN	X			
	74CN201B	GN		X		
R074	74CC161B	GN	X			
	74CC161C	GN	X			
R075	73DB232A	SC	X			
R076	74DG329C	SC	X			
R077	74DB415A	QD	X			
R078	74DG390A	SC			X	Sericitized
R079	74DB333B	GN		X		
R080	74DB332C	QZ		X		Altered ZO
R081	73AF285B	SC		X		3 x 50 m bleached ZO
R082	73DG378B	PH		X	X	
R083	73BC400A	GN	X			
R084	73BC398A	GN	X			
R085	73DG397A	QD	X			
R086	73DG394A	QD	X			
R087	73BC404A	QD	X			
R088	74CC139G	CS	X			

Table 9.—Descriptions of anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska--Continued

Map No.	Field No.	Description: Rock Type	Mineralization: Background No Visible Sulfides	Mineralization: FE Stain	Mineralization: Visible Sulfides	Other
R089	74CC138A	QD	X			
R090	73AF271A	PD	X			
	73AF271B	PD	X			Altered
R091	73DB239A	PD	X			
	73DB239B	PD	X			
	73DB239C	SE	X			
	73DB239D	PD	X			
	73DB239E	PD	X			
R092	74DB447C	PX	X			
R093	74DB446B	PX	X			
	74DB446C	GN	X			
	74DB446E	GN	X			
R094	74DG314A	GD	X			
R095	74DG319A	QM	X			
R096	74DG318C	GR	X			
R097	74DG317B	GB	X			
R098	74DG315A	SC	X			
R099	73AF281A	SC	X			
R100	73DB242B	SE	X			
	73DB242C	SE	X			
	73DB242E	PD	X			
R101	73DG406A	GN	X			
	73DG406B	PD	X			
R102	73DG407B	PX	X			
R103	73DB247A	GN	X			
R104	74DG346A	DI	X			
R105	74WV256A	DN	X			
R106	74AF154A	GD	X			
R107	74DG349A	GR	X			
R108	74DG350A	QM	X			
R109	74DG351B	AM			X	
	74DG351C	GN	X			
R110	74DG360B	AM	X			
R111	74DB340D	GN		X		
R112	74CN193B	GN		X		
R113	74AF237A	AK	X			
R114	74AF236A	QZ	X			
R115	74AF235A	GR	X			
R116	74CC099B	DI	X			
R117	74CN149B	GB	X			
R118	74CN236B	QZ		X		
R119	74CN168D	PX		X		Float
R120	74DB408B	GN	X			
R121	74DB406B	GN		X		ZO 10 x 400 m
	74DB406C	GN			X	Pod 5 x 50 cm
R122	74WV251C	HB	X			
R123	74DB222C	GN		X		
R124	74CN151D	CS	X			
R125	74CN152B	UP	X			
R126	74CN153C	GN		X		
R127	74CN093A	HB	X			
R128	74CN088A	SW			X	
	74CN088C	SW	X			
R129	74DG232A	GN		X		
R130	74CC062C	QZ	X			
R131	74WV165A	HB	X			

Table 9.--Descriptions of anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska--Continued

		Description				
		Rock Type	Mineralization			Other
Map No.	Field No.		Background No Visible Sulfides	FE Stain	Visible Sulfides	
R132	74CC093C	GN	X			
R133	74CN138E	IG	X			
	74CC091A	DI				
R134	74CC091C	HB				
R135	74WV200A	CS	X			
R136	74AF200A	GR	X			
R137	74AF201A	QM	X			
R138	74DB274B	UM	X			
R139	73DB220A	PH			X	Cu stain
R140	73DB222F	PH			X	Cu stain
R141	73DG387A	SC	X			
R142	73DG389A	SC	X			
R143	73AF256A	SC		X		
R144	73AF254D	SC		X		ZO 30 x 50 m
R145	74DB296C	GN	X			
R146	74DB297E	SC	X			
R147	74AF251A	GS	X			
	74AF251B	GS			X	
R148	73BC254A	PH	X			
R149	73BC258A	PH	X			
R150	73BC336B	PH	X			
	73BC336C	QZ	X			
R151	73DG275A	PH	X			
R152	74AF233A	PH	X			
R153	74DB324C	GN		X		ZO 2 m wide
R154	74CC087G	QZ	X			
R155	74CC086B	GN	X			
R156	74DB322B	GN		X	X	
R157	74DG301B	SC			X	Oxidized zone .3 m wide
	74DG301D	GN		X		ZO 2 m wide
R158	74CN130B	QZ	X			
R159	74CN133C	SI	X			
R160	74CN082A	GS	X			
R161	74AF066A	TO	X			
R162	74AF163A	SC	X			
R163	74DB164A	MB		X		
R164	74DB162C	SC	X			
R165	74CN078C	QZ	X			
R166	74DG209A	SC	X			
R167	74CN070B	QD		X		
R168	74CN072A	GN	X			
R169	74CN071B	GN	X			
R170	73DG260A	GD	X			
R171	74WV186D	CS		X		
R172	74DG158B	GN		X		ZO 25 x 10 m
R173	73DG265A	GD	X			
R174	73DG264A	GN		X		
R175	74AF209A	SC	X			
R176	74WV181A	GN		X		
R177	74DB194B	GN	X			
R178	74AF124A	IG	X			
R179	73HB002A	PH	X			
R180	73HB004A	PH	X			
R181	73HB006B	PH		X	X	

Table 9.--Descriptions of anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska.--Continued

		Description				
		Rock Type	Mineralization			Other
Map No.	Field No.		Background No Visible Sulfides	FE Stain	Visible Sulfides	
R182	73HB016C	SC		X	X	ZO 2 m wide
R183	73HB028A	PH		X	X	
R184	74DG241A	SI	X			
R185	73DB016B	PH	X			
R186	73DB013B	QZ		X		
R187	73DB003A	PH	X			
R188	73HB027B	QZ	X			
R189	74CN097C	GS	X			
R190	74CN098A	PH		X		
R191	74WV158B	MB	X			
R192	74DB125D	AM	X			
R193	74WV043A	GN		X		
R194	74AF177D	QZ	X			
R195	74WV150A	PH			X	
R196	74DB218B	PH			X	
	74DB218C	QZ		X	X	
R197	74WV055A	PH		X		
R198	73DG189A	PH	X			
R199	73DB165C	PH	X			
R200	73DG239A	GD	X			
R201	73BL003A	PH	X			
R202	73HB034B	QZ	X			
R203	73BC331A	SC	X			
R204	73DG245A	PH	X			
R205	73AF107B	SC		X		
R206	73AF106A	PH	X			
R207	74WV050A	DI		X		
R208	74WV052A	DI		X		
R209	74DB209B	PH			X	
R210	74DG196A	AK			X	
R211	74DG173A	GD	X			
R212	74AF109C	UM	X			
R213	74AF108C	SP			X	
R214	74AF106B	PD			X	
	74AF106G	SP			X	
R215	74CC010A	GS	X			
R216	73DG288B	QZ	X			
R217	73BL006A	SC	X			
R218	74DB104A	GS	X			
R219	73DB149D	PH		X		
R220	74DG131A	PH	X			
R221	74CN051A	SC	X			
R222	73DB145B	GS			X	
	73DB145D	QZ			X	
R223	73DB170B	PH	X			
R224	73SN010A	SC		X	X	
R225	73AF094B	SC		X		
R226	73DG371A	QZ	X			
R227	74AF137A	MB	X			
R228	74WV121A	GN	X			
R229	74WV183A	QD	X			
	74WV183B	GB	X			
R230	74AF123A	HB	X			
R231	74DB193A	UM	X			
R232	74WV190B	MB	X			
R233	74DB195B	GN		X		

Table 9.--Descriptions of anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area, Alaska.--Continued

Map No.	Field No.	Description: Rock Type	Mineralization: Background No Visible Sulfides	Mineralization: FE Stain	Mineralization: Visible Sulfides	Other
R234	74DB205A	GN	X			
	74DB205B	GN		X		ZO 1.5 m thick
R235	74DB206B	GN	X			
R236	73DB216D	GN		X		
R237	73DB212A	BG	X			
R238	73AF158A	SC	X			
R239	73DG316A	GN	X			
R240	74AF073C	SC		X		ZO 10-15 m thick
R241	74AF074A	SC	X			
R242	74DG136A	AM	X			
R243	73DB182B	GN		X		
R244	73DB181B	GN		X		
R245	73DB176B	SC		X		ZO 1 m thick
R246	73DB179C	CS	X			
R247	73DB178A	QD	X			
R248	73DB173B	SC	X			
	73DB173E	SC		X		
R249	73DB172D	QZ	X			
R250	74DG134C	GN		X	X	
R251	74DG133B	GN		X		ZO 1 m long
R252	73BC360A	GD	X			
R253	73SN014B	GN		X	X	
R254	73BL023A	BG	X			
R255	74DB184E	GN	X			
R256	73DG335B	QD	X			
R257	73DG340A	DN	X			
R258	73SN019A	GN	X			
R259	73BL016A	QM	X			
R260	73BL012A	QM	X			
R261	73DB197A	QM	X			
R262	73BL014A	QM	X			

Interpretation of geochemical data

Gold and silver

Gold is the only major metal produced from the area. All production was from lode and placer deposits at the head of Windham Bay and from the Sumdum Chief mine. Silver accompanies gold in these deposits and is also present in varying amounts in most of the other prospects in the area. These known occurrences of gold and silver are consistent with the geochemical data.

The actual geochemical abundance of gold and silver is not known because of the detection limits imposed by the analytical methods. Gold could not be measured in amounts less than 0.1 ppm or silver in amounts less than 0.5 ppm. Levinson (1974) states that the average crustal abundance of silver is 0.07 ppm and that most rocks contain less than 0.1 ppm; the average crustal abundance of gold is 0.004 ppm and most rocks contain less than 0.005 ppm. Thus, any gold and silver detected in this study was well above average crustal abundance values and the anomalous levels were set at or just above the limits of detection.

The distribution of anomalous gold and silver in the Tracy Arm-ords Terror area (fig. 10) shows a marked concentration in the western

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Figure 10 near here.

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metamorphic belt. Anomalous gold and silver occur in both stream sediments and rocks throughout this belt (with the exception of at its southern end where sample locality density is less (plate 2)). In part, this concentration of anomalous samples reflects the known mineralization near the Sumdum Chief mine and Windham Bay and along the Sumdum Glacier mineral belt, but the distribution suggests that the mineralization is widespread. The Coast Range batholithic complex shows a widely scattered distribution of anomalous gold and silver samples. Most of these samples are in or associated with the metamorphic rocks of the complex.

The geochemical work substantiates the southern extension of the Juneau gold belt and points toward a number of the known gold prospects. It also helped lead to the previously unknown gold mineralization in the Sweetheart Ridge mineralized zone. The distribution of anomalous gold and silver samples probably also indicates that precious metal mineralization is more widespread, particularly in the western metamorphic belt, than is now recognized.

Copper

Although copper has not been produced from the Tracy Arm-Fords Terror area, it is the main commodity of interest in the deposits of the Sumdum Glacier mineral belt.

The copper content of the rock units does not vary markedly from the amount to be expected in such rocks (Cox and others, 1973), but the distribution varies distinctly from unit to unit (fig. 11). The

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Figure 11 near here.

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ultramafic rocks contain by far the most copper with values ranging from less than 5 ppm to 2,000 ppm. The world average copper content of ultramafics is stated to be 15 ppm, and the great variability in values here may only represent the natural range and the diversity of the ultramafic rocks. Some of the ultramafics, such as that at Windham Bay which has distinctly anomalous copper in both rocks and stream sediments associated with it (fig. 12), may represent a copper resource. Their

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Figure 12 near here.

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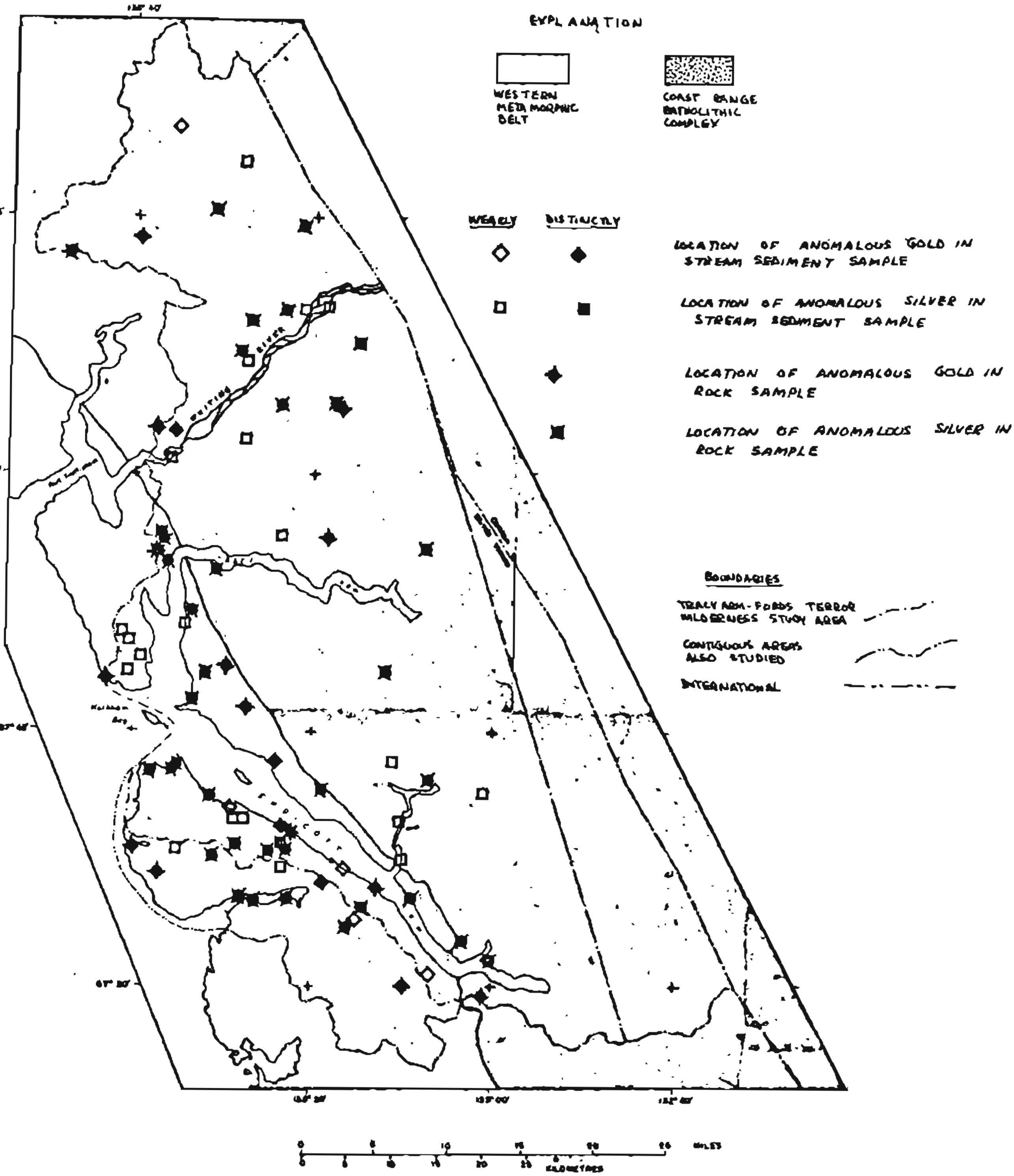
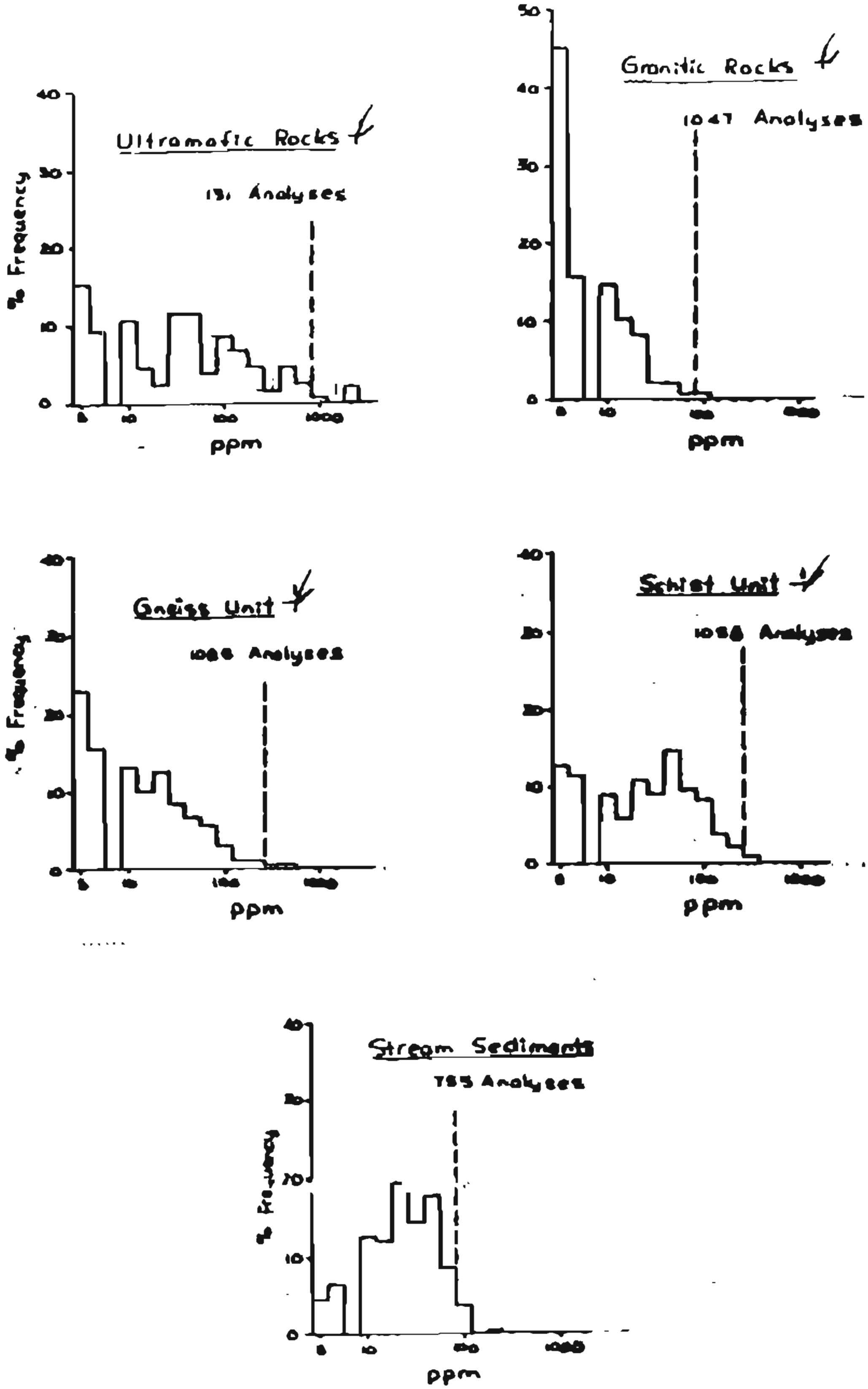
small size would limit their significance.



Au & Ag

Figure 10.--

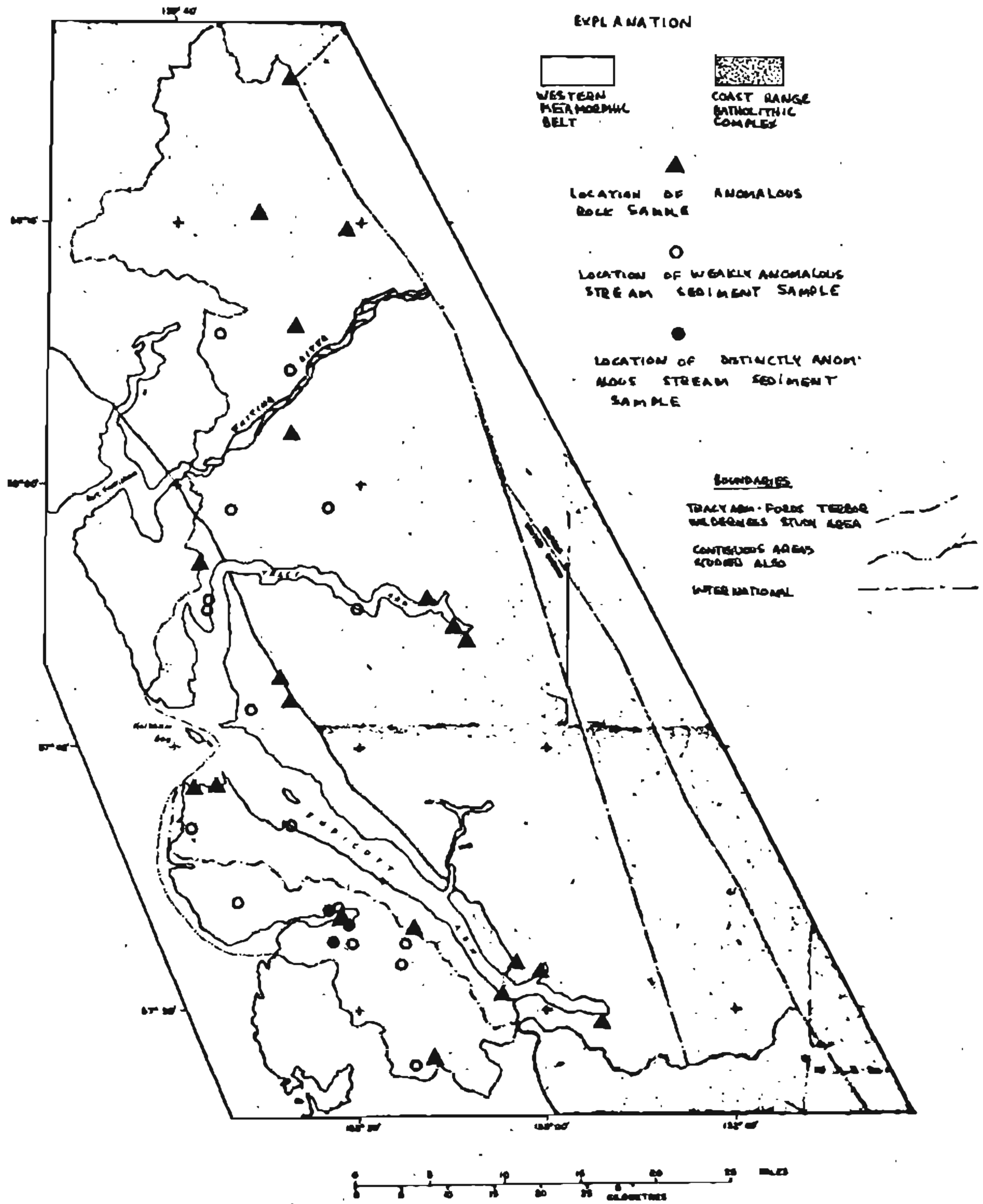
Figure 10.--Location of anomalous gold and silver in rocks and stream sediments, Tracy Arm-Fords Terror Wilderness Study area, Alaska.



Ultramafic Rocks
131 Analyses
Granitic Rocks
1047 Analyses
Gneiss Unit
Schist Unit
Stream Sediments
% Frequency
ppm

Figure 11.

Figure 11.--Histograms of the distribution of copper in rock and stream sediment samples.


EXPLANATION
WESTERN METAMORPHIC BELT
COAST RANGE BATHOLITHIC COMPLEX
LOCATION OF ANOMALOUS ROCK SAMPLE
LOCATION OF WEAKLY ANOMALOUS STREAM SEDIMENT SAMPLE
LOCATION OF DISTINCTLY ANOMALOUS STREAM SEDIMENT SAMPLE
BOUNDARIES
TRACY ARM - FORDS TERROR WILDERNESS STUDY AREA
CONTIGUOUS AREAS STUDIED ALSO
INTERNATIONAL
ENDICOTT
RIVER

Cu

Figure 12. --

Figure 12.--Location of anomalous copper in rocks and stream sediments, Tracy Arm-Fords Terror Wilderness Study Area, Alaska.

The granitic and metamorphic rocks in the study area yielded many samples that are above the average crustal abundance of copper for such rocks. The average world granite contains 15 ppm copper with a generally reported range of 5-30 ppm. Most sedimentary rocks contain an average of 15-45 ppm copper with a generally reported range of 2 to 120 ppm. In the study area, the schist bedrock geochemical unit contains the highest copper content of any of the non-ultramafic rocks with an average value of about 50 ppm. This value is not unlikely because andesites and shales, which are probable precursors of the dominant greenschist and phyllite in the schist unit, have 35 ppm and 45 ppm, respectively. Even though the anomalous level for the schist unit was set higher than for the granitic and gneissic rocks (table 7), the unit still contains the greatest number of the anomalous rocks and stream sediments in the area (fig. 12). In contrast, the rocks in the Coast Range batholithic complex contain only a few anomalous samples and most of these are in the metamorphic rocks in the complex.

The histogram of the stream sediment samples indicates a marked concentration of copper as compared to the granitic and metamorphic rocks. If the copper in the stream sediments were the product of mechanical breakdown of these rocks and direct deposition of that material in the stream, then the copper distribution in the stream sediments should directly reflect the average copper content of the granitic and metamorphic rocks; instead the sediments show few values below 10 ppm copper. The high copper content of the ultramafic rocks may explain some of the high values, but they cannot explain the relative lack of values below 10 ppm. It is likely that copper is being selectively absorbed in clay minerals, organic material and iron hydroxides in the stream sediments as the copper travels in solution after the breakdown of the source rocks.

In respect to the copper resources of the area, perhaps the most significant aspect of the stream sediments is that they do not necessarily indicate known mineralization. The Sumdum Glacier mineral belt, which contains two prominent copper prospects, the Tracy Arm and the Sumdum, is notably lacking in anomalous stream sediment samples.

Molybdenum

The actual abundance of molybdenum is not known because the 5 ppm detection limit of the analytical method used is well above the average geochemical abundance of molybdenum in most crustal rocks. Levinson (1974) gives the average crustal abundance of 1.5 ppm with a maximum average of 3 ppm in granite for igneous rocks and 3 ppm in shales for sedimentary rocks. More than 15 percent of the rocks and stream sediments collected in this study exceed the detection limit and the actual number of samples exceeding the average crustal abundance is probably much higher.

The histograms (fig. 13) of molybdenum in the rocks and stream

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Figure 13 near here.

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sediments are generally similar although the gneiss unit and schist unit has a somewhat higher molybdenum content than the granitic rocks. The distribution of molybdenum-rich samples (fig. 14) shows that most of the

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Figure 14 near here.

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anomalous samples occur in the northwestern two-thirds of the study area.

The geochemical data suggest higher local, if not general, molybdenum values than might be expected and further prospecting for molybdenum might find some new occurrences. The area just north of Windham Bay on the Endicott Peninsula is particularly attractive because it has a number of anomalous stream sediments and rocks associated with a hypabyssal, porphyritic garnet-biotite-hornblende diorite and this area is known only through reconnaissance study.

Lead

Lead is not the chief commodity of interest in any deposit in the study area, even though it is present in minor amounts in many of the deposits of the area. Relatively few rock or stream sediment samples are anomalous in lead and almost none markedly anomalous.

Levinson (1974) indicates the average granite contains 20 ppm lead, the average granodiorite 15 ppm and the average shale 20 ppm. The granitic rocks in this area (fig. 15) rarely contain as much as the

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Figure 15 near here.

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crustal average; in general they are markedly lower. The metamorphic rocks show a somewhat higher lead content but only a few values as high as 100 ppm. The schist unit, which comprises most of the western metamorphic belt of figure 16, shows not only the highest lead content

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Figure 16 near here.

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but also the greatest number of anomalous rock and stream sediment samples. The gneissic rocks of the batholithic complex have scattered anomalous occurrences in rocks and stream sediment samples, particularly between the Whiting River and Tracy Arm.

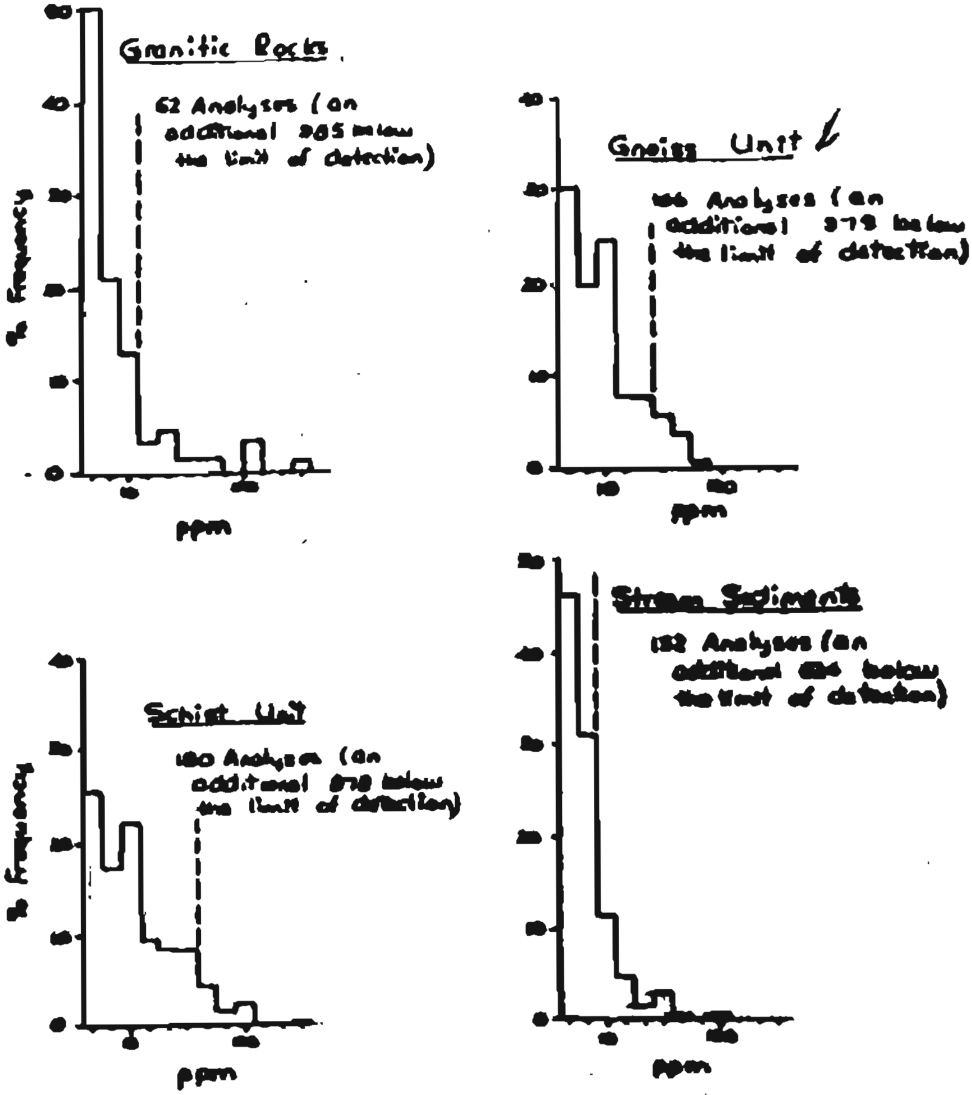
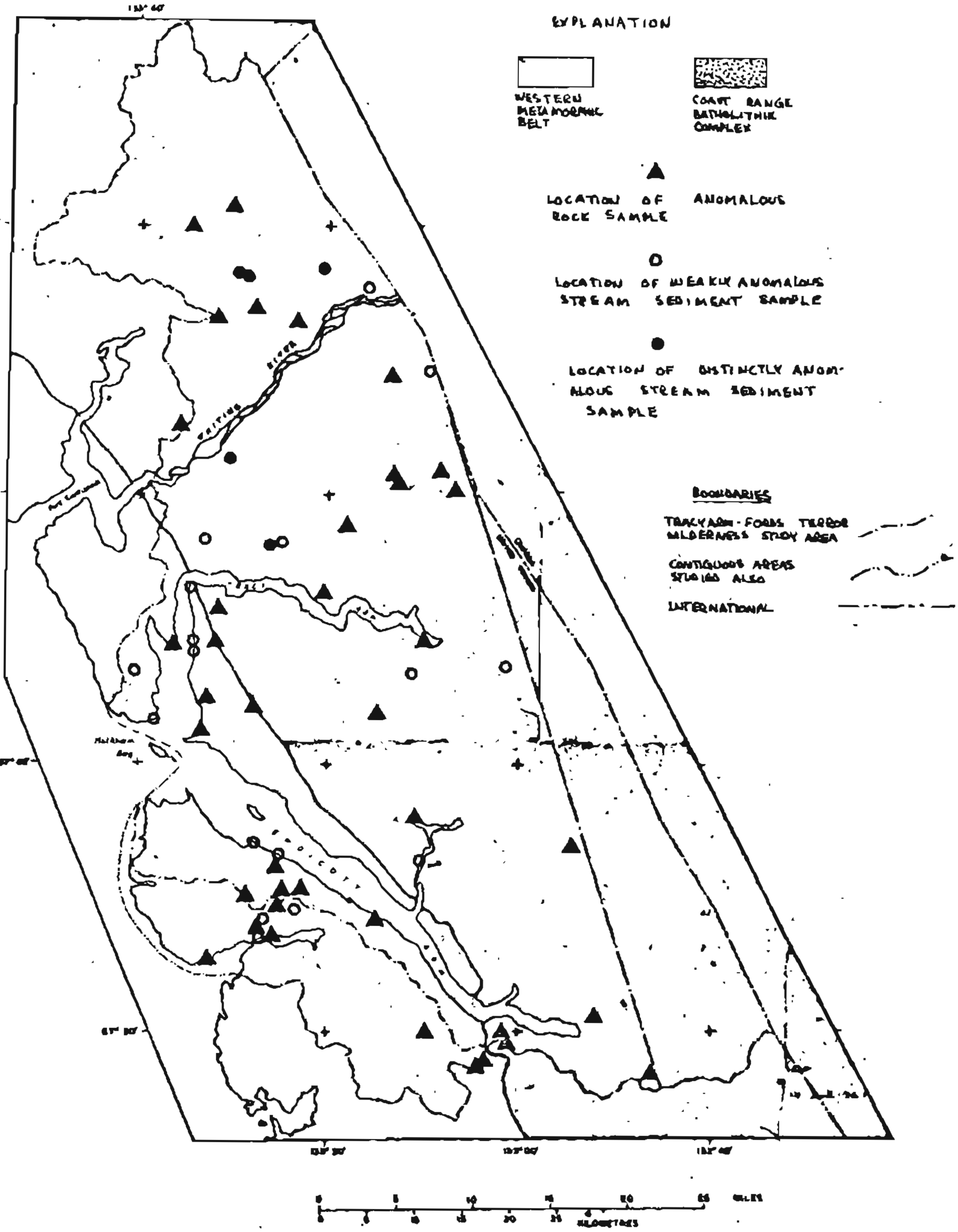

Granitic Rocks
62 Analyses (an additional 285 below the limit of detection)
% Frequency
ppm
Gneiss Unit
Analyses (an additional 379 below the limit of detection)
ppm
Schist Unit
Analyses (an additional below the limit of detection)
% Frequency
ppm
Stream Sediments
Analyses (an additional below the limit of detection)
ppm

Figure 13.

Figure 13.--Histograms of the distribution of molybdenum in rocks and stream sediment samples.

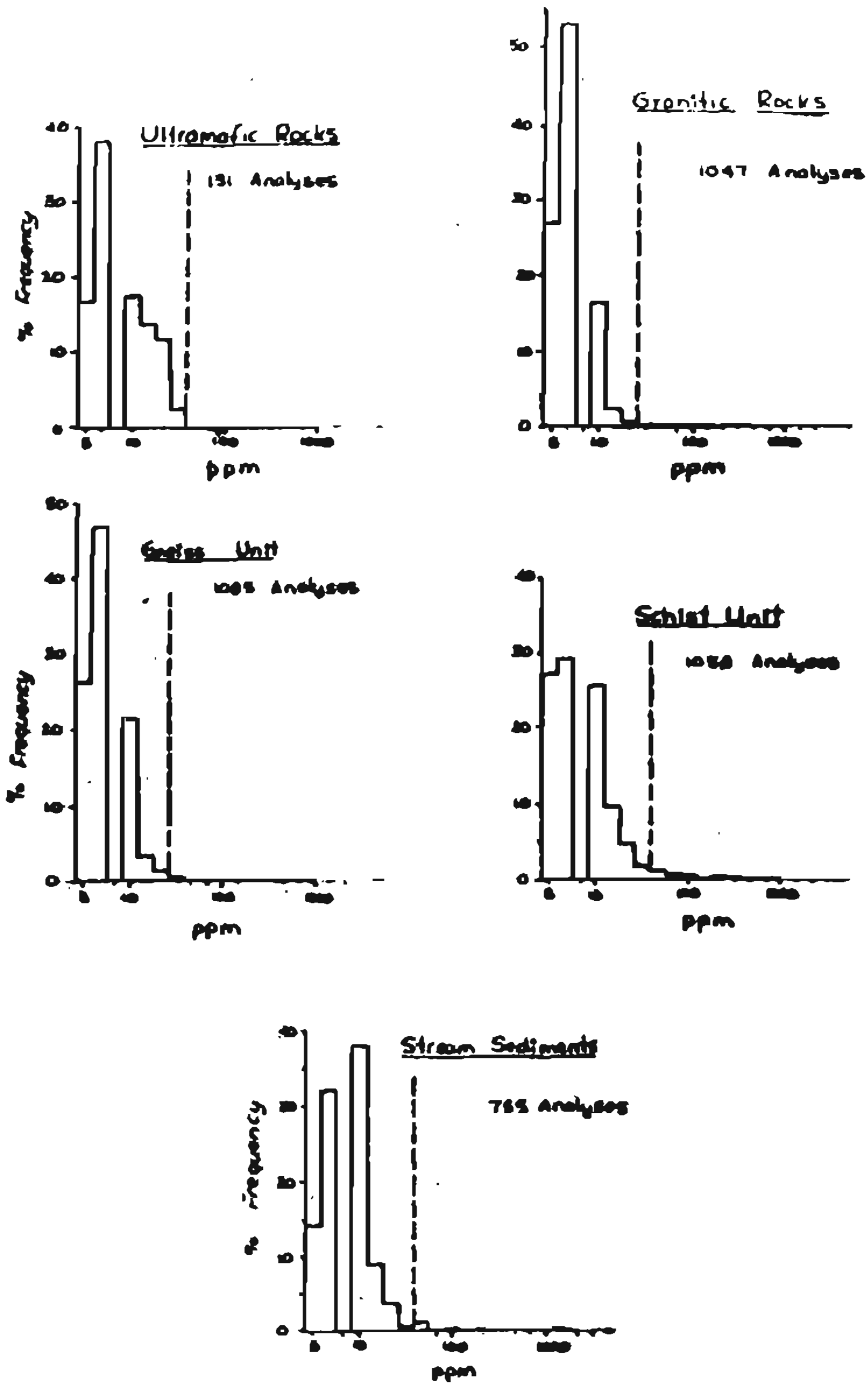
[Values to the right of the vertical dashed line are anomalous as defined in this report (tables 4 and 7). Analyses by semi-quantitative spectrographic method reported in a six-step series utilizing the values . . . 1, 1.5, 2, 3, 5, 7, 10 . . . as the midpoints of the steps. Only values above the limit of detectability used.]


EXPLANATION
WESTERN METAMORPHIC BELT
COAST RANGE BATHOLITHIC COMPLEX
LOCATION OF ANOMALOUS ROCK SAMPLE
LOCATION OF WEAKLY ANOMALOUS STREAM SEDIMENT SAMPLE
LOCATION OF DISTINCTLY ANOMALOUS STREAM SEDIMENT SAMPLE
BOUNDARIES
TRACY ARM - FORDS TERROR WILDERNESS STUDY AREA
CONTIGUOUS AREAS STUDIED ALSO
INTERNATIONAL
MILES
KILOMETRES

Mo

Figure 14 --

Figure 14.--Location of anomalous molybdenum in rocks and stream sediments, Tracy Arm-Fords Terror Wilderness Study Area, Alaska.

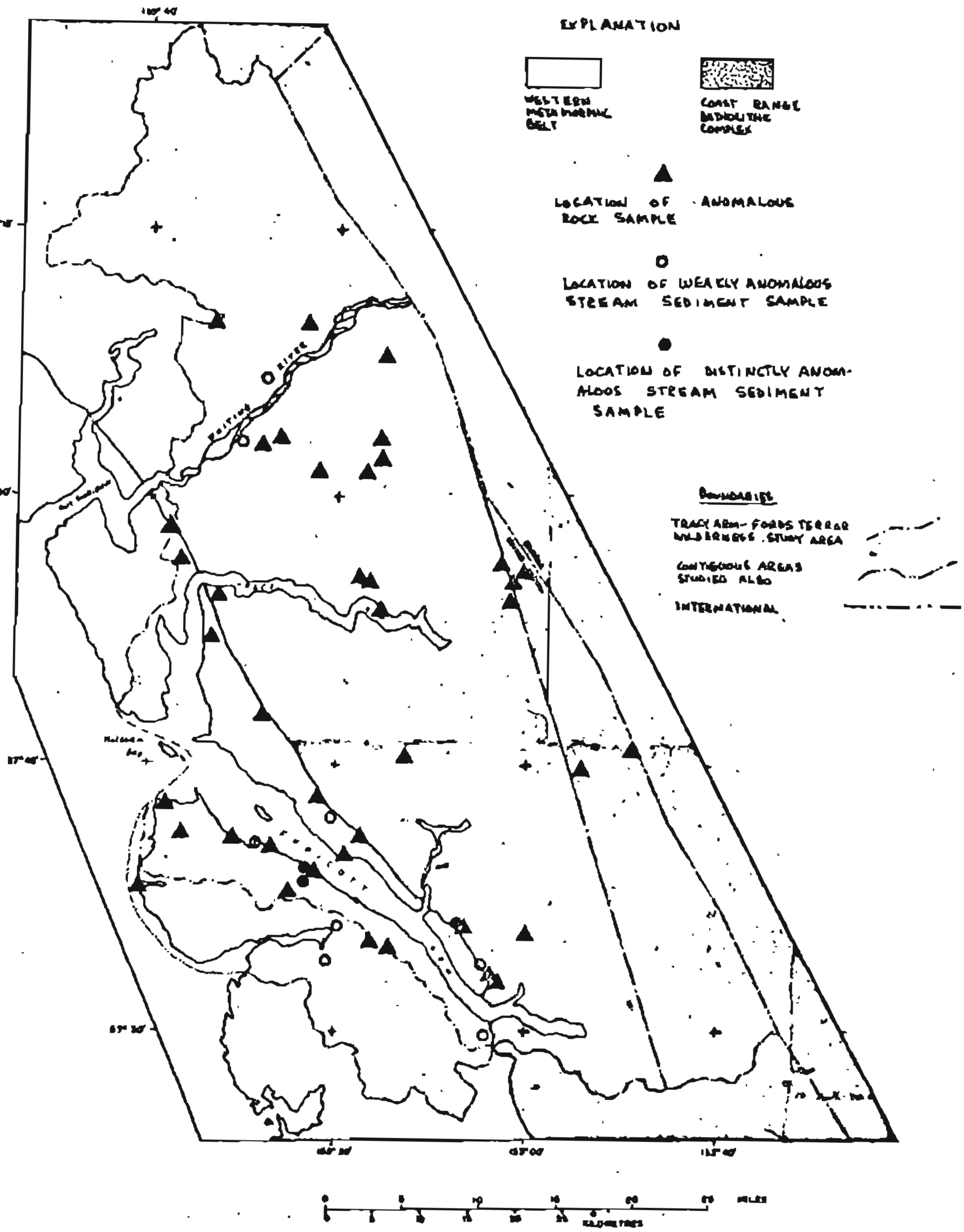


Ultramafic Rocks
131 Analyses
% Frequency
ppm
Granitic Rocks
1047 Analyses
ppm
Gneiss Unit
% Frequency
ppm
Schist Unit
ppm
Stream Sediments
% Frequency
ppm

Figure 15.

Figure 15.--Histogram of the distribution of lead in rock and stream sediment samples.

[Values to the right of the vertical dashed line are anomalous as defined in this report (tables 4 and 7). Analyses by atomic absorption reported in a six-step series utilizing the values . . 1, 1.5, 2, 3, 5, 7, 10 . . . as the midpoints of the steps. B indicates the element was not detected or was detected and below the level of determination.]


EXPLANATION
WESTERN METAMORPHIC BELT
COAST RANGE BATHOLITHIC COMPLEX
LOCATION OF ANOMALOUS ROCK SAMPLE
LOCATION OF WEAKLY ANOMALOUS STREAM SEDIMENT SAMPLE
LOCATION OF DISTINCTLY ANOMALOUS STREAM SEDIMENT SAMPLE
BOUNDARIES
INTERNATIONAL
MILES
KILOMETRES

Pb

Figure 16...

Figure 16.--Location of anomalous lead in rocks and stream sediments, Tracy Arm-Fords Terror Wilderness Study Area, Alaska.

The lead content of the ultramafic rocks is exceedingly high in comparison to its average crustal abundance. Levinson (1974) states that the average lead content of ultramafic rocks is 0.1 ppm and Goles (1967) indicates even less. Those figures may be low because of inadequate data but it is interesting that at least 70 percent of the ultramafic rock samples from the study area contain two to three orders of magnitude more lead than that. This unexplained discrepancy is probably not significant as no economic lead deposits are known in ultramafic rocks (Morris and others, 1973). There is no evidence that the high lead content of these rocks is of more than academic interest.

The geochemical data suggest the absence of significant lead deposits in the study area. The distribution of samples with anomalous values does, however, support the general concept of base metal mineralization in the western metamorphic belt.

Zinc

Zinc is present as sphalerite in minor to trace amounts in a number of deposits in the area; but it is of potential economic value only at the Tracy Arm prospect. Few of the rock and stream sediment samples from the area exceed the average crustal abundance values for zinc.

Levinson (1974) indicates most rocks contain 25 to 100 ppm zinc; Wedow and others (1973) give similar values and emphasize that certain rocks, for instance carbonaceous shales, may contain several thousand ppm or more zinc. A few of the rocks (fig. 17) in the study area

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Figure 17 near here.

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contain 1,000 ppm zinc, but most histograms have a symmetrical distribution centered at about the average crustal abundance. The distribution of zinc in stream sediments is about what would be expected of a weighted composite of the rocks of the area.

The geographic distribution of the rocks and stream sediment samples anomalous in zinc (fig. 18) indicate a concentration in the

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Figure 18 near here.

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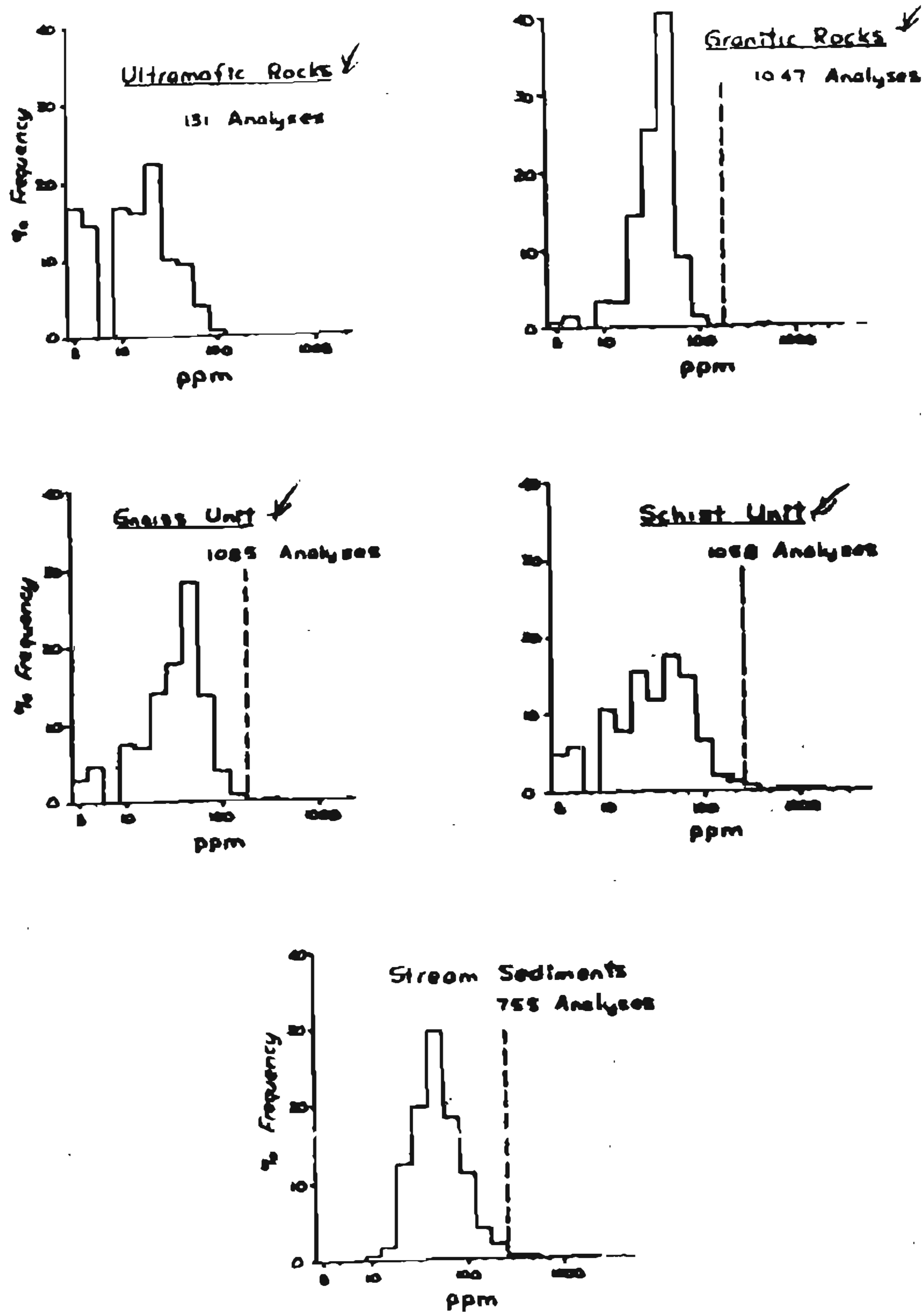
western metamorphic belt. However, the concentration is not pronounced nor are the values so high as to suggest significant zinc occurrences.

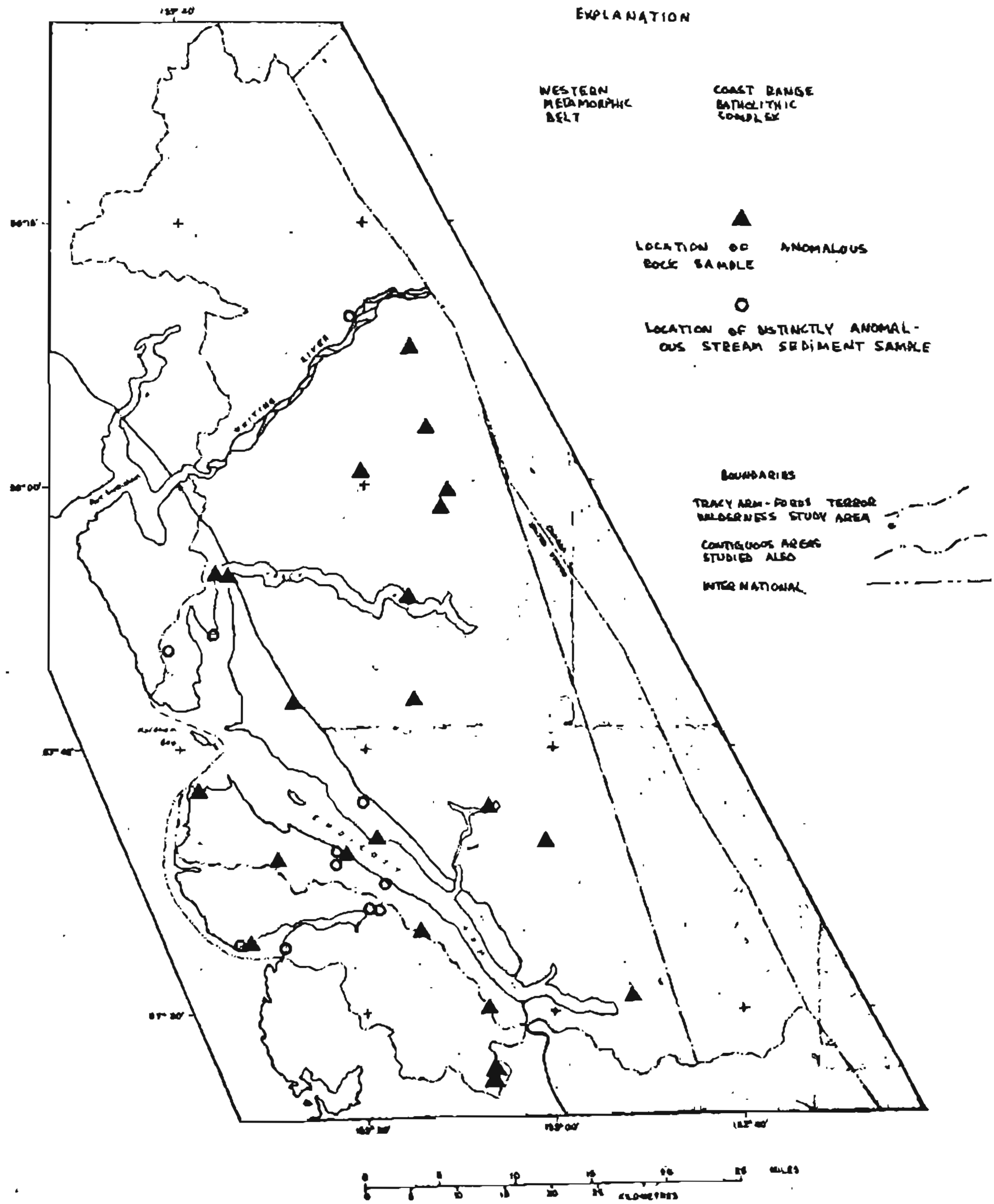


Ultramafic Rocks
131 Analyses
Granitic Rocks
1047 Analyses
Gneiss Unit
1085 Analyses
Schist Unit
1058 Analyses
Stream Sediments
755 Analyses
% Frequency
ppm

Figure 17.

Figure 17.--Histograms of the distribution of zinc in rock and stream sediment samples.

[Values to the right of the vertical dashed line are anomalous as defined in this report (tables 4 and 7). Analyses by atomic absorption reported in a six-step series utilizing the values . . 1, 1.5, 2, 3, 5, 7, 10 . . . as the midpoints of the steps. B indicates the element was not detected or was detected and below the level of determination.]



EXPLANATION
WESTERN METAMORPHIC BELT
COAST RANGE BATHOLITHIC COMPLEX
LOCATION OF ANOMALOUS ROCK SAMPLE
LOCATION OF DISTINCTLY ANOMALOUS STREAM SEDIMENT SAMPLE
BOUNDARIES
TRACY ARM - FORDS TERROR WILDERNESS STUDY AREA
CONTIGUOUS AREAS STUDIED ALSO
INTERNATIONAL
WHITING RIVER
MILES
KILOMETRES

Zn

Figure 18.--

Figure 18.—Location of anomalous zinc in rocks and stream sediments, Tracy Arm-Fords Terror Wilderness Study Area.

Chromium and nickel

Many of the rocks in the study area have an unusually high chromium and nickel content (figs. 19 and 20). Both these elements are

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Figures 19 and 20 near here.

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preferentially concentrated in ultramafic rocks and Levinson (1974) gives an average content of 2,000 ppm chromium and nickel for such rocks. In contrast, igneous rocks further along the differentiation trend have lesser amounts: basalts average 200 ppm chromium and 150 ppm nickel, granodiorites 20 ppm chromium and nickel, and granites 4 ppm chromium and 0.5 ppm nickel. Most sedimentary rocks contain less than 100 ppm chromium (Thayer, 1973) and nickel (Cornwall, 1973). Although the rocks in the study area follow these patterns in general, many of the rocks contain chromium and nickel in amounts well above average crustal abundances. For example, one-third of the samples in the schist bedrock geochemical unit contain more than 100 ppm chromium and some up to 2,000 ppm; the granitic rocks contain up to 700 ppm chromium and 200 ppm nickel. These differences may be due to either 1) incomplete data on the crustal abundance of chromium and nickel, or 2) an unusual amount of chromium and nickel in the rocks of this particular area. It is extremely unlikely that the high chromium and nickel values in the granitic and metamorphic rocks have any mineral resource significance as economic deposits of both are almost totally restricted to ultramafic or mafic igneous rocks or their weathered zones.

The distribution of chromium and nickel in stream sediments of the area (figs. 19 and 20) coincides with their average abundance in crustal rocks. Levinson (1974) indicates an average of 100 ppm chromium and 75 ppm nickel in the crust; the distribution of both in stream sediments of this area is symmetrical and centered just below the average crustal levels. The higher values of both chromium and nickel are found close to areas of ultramafic rocks (plate 2). Chromium and nickel in stream sediments are clear guides to the ultramafic bodies in the area and it is unlikely that any additional large ultramafic bodies are present.

Mercury

The mercury content of the rocks and stream sediments in the study area (fig. 21) are well within normal background. Fleischer (1970) and

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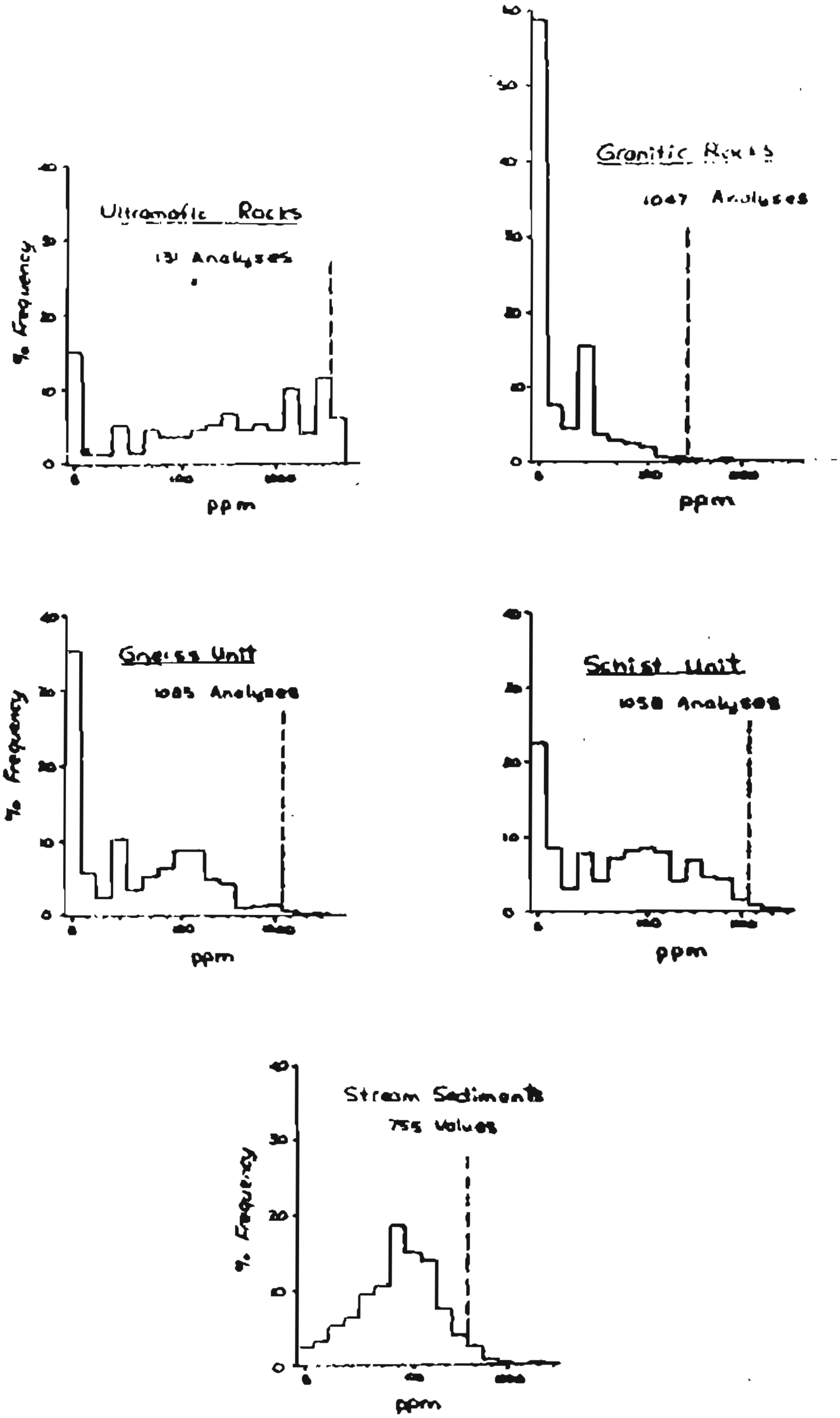
Figure 21 near here.

Pierce, Botbol and Learned (1970) show a wide range in the mercury content of crustal material but indicate that most rocks and stream sediments contain less than 0.2 ppm mercury and less than 20 percent are above 1 ppm. Only a few mercury values above 0.2 ppm and none above 1 ppm were found in the samples collected in this area.

Southeastern Alaska has no known mercury deposits. The mercury content of the rocks and stream sediments collected during this study suggests there are none in the study area.

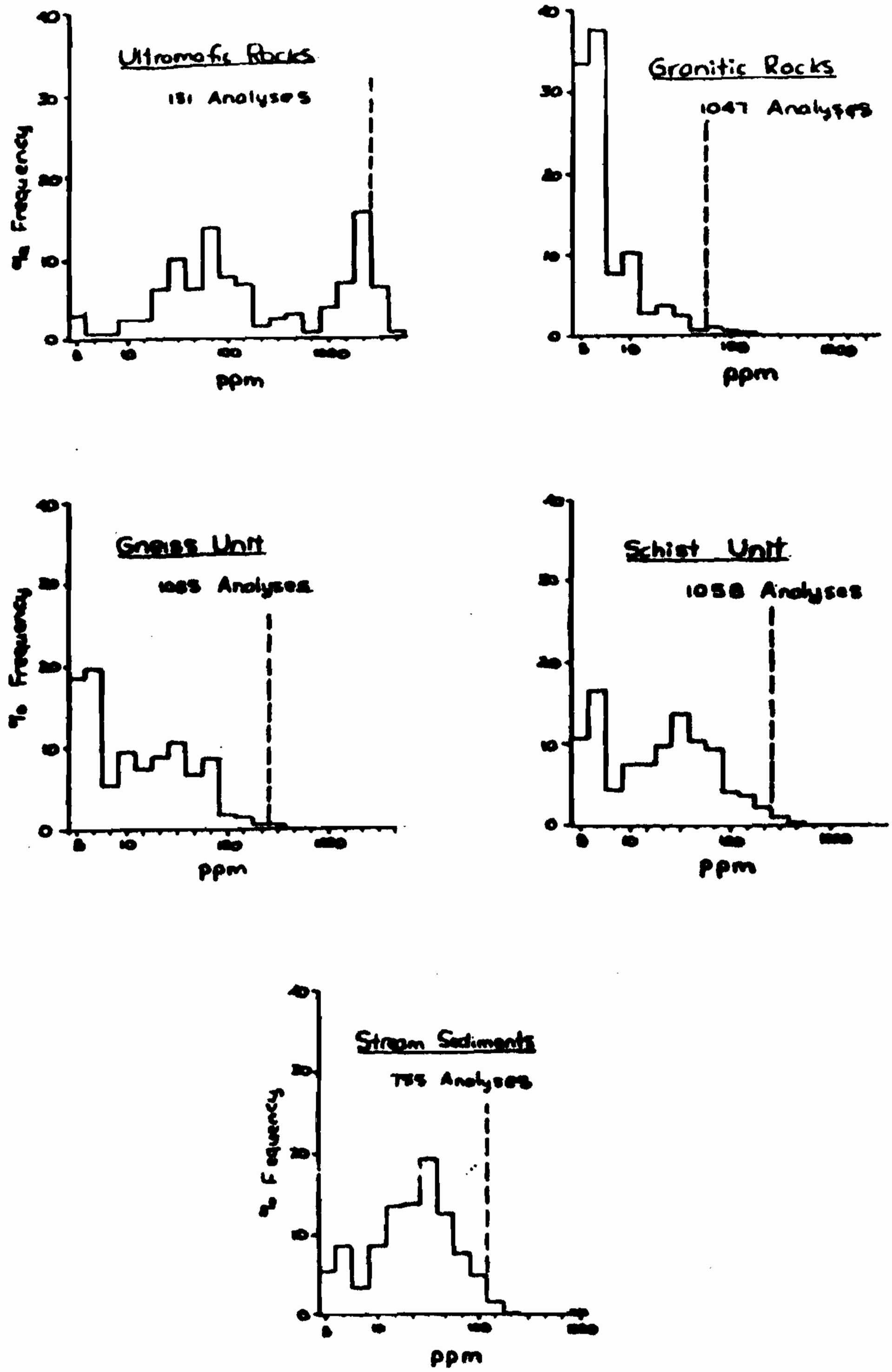


Ultramafic Rocks
131 Analyses
% Frequency
ppm
Granitic Rocks
1047 Analyses
ppm
Gneiss Unit
1085 Analyses
% Frequency
ppm
Schist Unit
1058 Analyses
ppm
Stream Sediments
755 Values
% Frequency
ppm

Figure 19.

Figure 19.--Histograms of the distribution of chromium in rocks and stream sediment samples.

[Values to the right of the vertical dashed line are anomalous as defined in this report (tables 4 and 7). Analyses by semi-quantitative spectrographic method reported in six-step series utilizing the values . . . 1, 1.5, 2, 3, 5, 7, 10 . . . as the midpoints of the steps. B indicates the element was not detected or was detected and below the level of determination.]



Ultramafic Rocks
151 Analyses
% Frequency
ppm
Granitic Rocks
1047 Analyses
ppm
Gneiss Unit
% Frequency
ppm
Schist Unit
1058 Analyses
ppm
Stream Sediments
% Frequency
ppm

Figure 20.

Figure 20.--Histograms of the distribution of nickel in rocks and stream sediment samples.

[Values to the right of the vertical dashed line are anomalous as defined in this report (tables 4 and 7). Analyses by semi-quantitative spectrographic method reported in a six-step series utilizing the values . . . 1, 1.5, 2, 3, 5, 7, 10 . . . as the midpoints of the steps. B indicates the element was not detected or was detected and below the level of determination.]

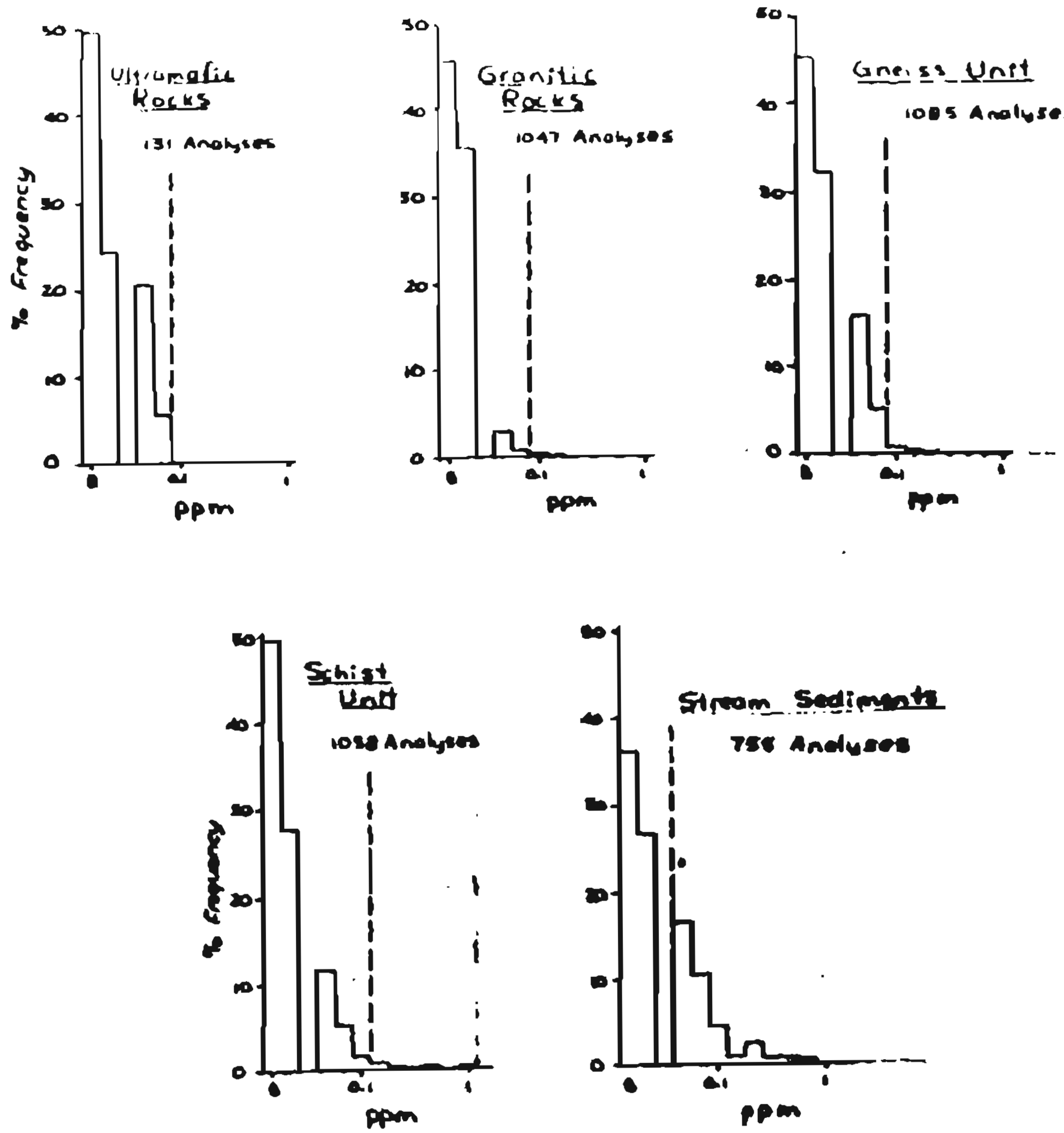

Ultramafic Rocks
131 Analyses
Granitic Rocks
1047 Analyses
Gneiss Unit
1085 Analyses
Schist Unit
1058 Analyses
Stream Sediments
756 Analyses
% Frequency
ppm

Figure 21.

Figure 21.--Histograms of the distribution of mercury in rocks and stream sediment samples.

[Values to the right of the vertical dashed line are anomalous as defined in this report (tables 4 and 7). Analyses by mercury vapor detector reported in a six-step series utilizing the values . . . 0.1, 0.15, 0.2, 0.3, 0.5, 0.7, 1.0 . . . as the midpoints of the steps. B indicates the element was not detected or was detected and below the level of determination.]

Beryllium, tin, bismuth, and tungsten

Beryllium, tin, bismuth and tungsten occur in a variety of types of deposits but are generally associated with silicic igneous rocks. No tin, bismuth or tungsten minerals have been identified from the area. A meter wide by 30 meters long pegmatite dike about 4 km south of the terminus of the Dawes Glacier contains scattered beryl crystals up to 15 cm long, but that occurrence is apparently unique in the area.

Levinson (1974) indicates that the average beryllium content of the crust is 2.8 ppm with a maximum of 5 ppm in granitic rocks; the average tin content is 2 ppm with 3 to 4 ppm in granites, shales and limestone; the average bismuth content is 0.17 ppm; and the average tungsten content of the crust is 1.5 ppm with an average of 2 ppm in mafic to silicic igneous rocks. The crustal abundance of those elements is, with the exception of beryllium which can be detected at 1 ppm, much lower than the detection limits of the analytical procedures used. Thus any tin, bismuth, and tungsten detected in this study is of possible significance.

The distribution of anomalous beryllium, tin, bismuth and tungsten (fig. 22) in rocks and stream sediments of the study area shows no

Figure 22 near here.

pronounced patterns. Most of the anomalous samples occur in the Coast Range batholithic complex near the head of Endicott Arm or in the western metamorphic belt adjacent to it. The reason for this grouping is unknown. In general, very few of the samples collected were anomalous in any of these elements and none were anomalous to a degree that suggested a potential resource. In more than 5,000 samples, the maximum values recorded for these elements were 30 ppm beryllium, 100 ppm bismuth, 70 ppm tin and 200 ppm tungsten, and these values were atypical.

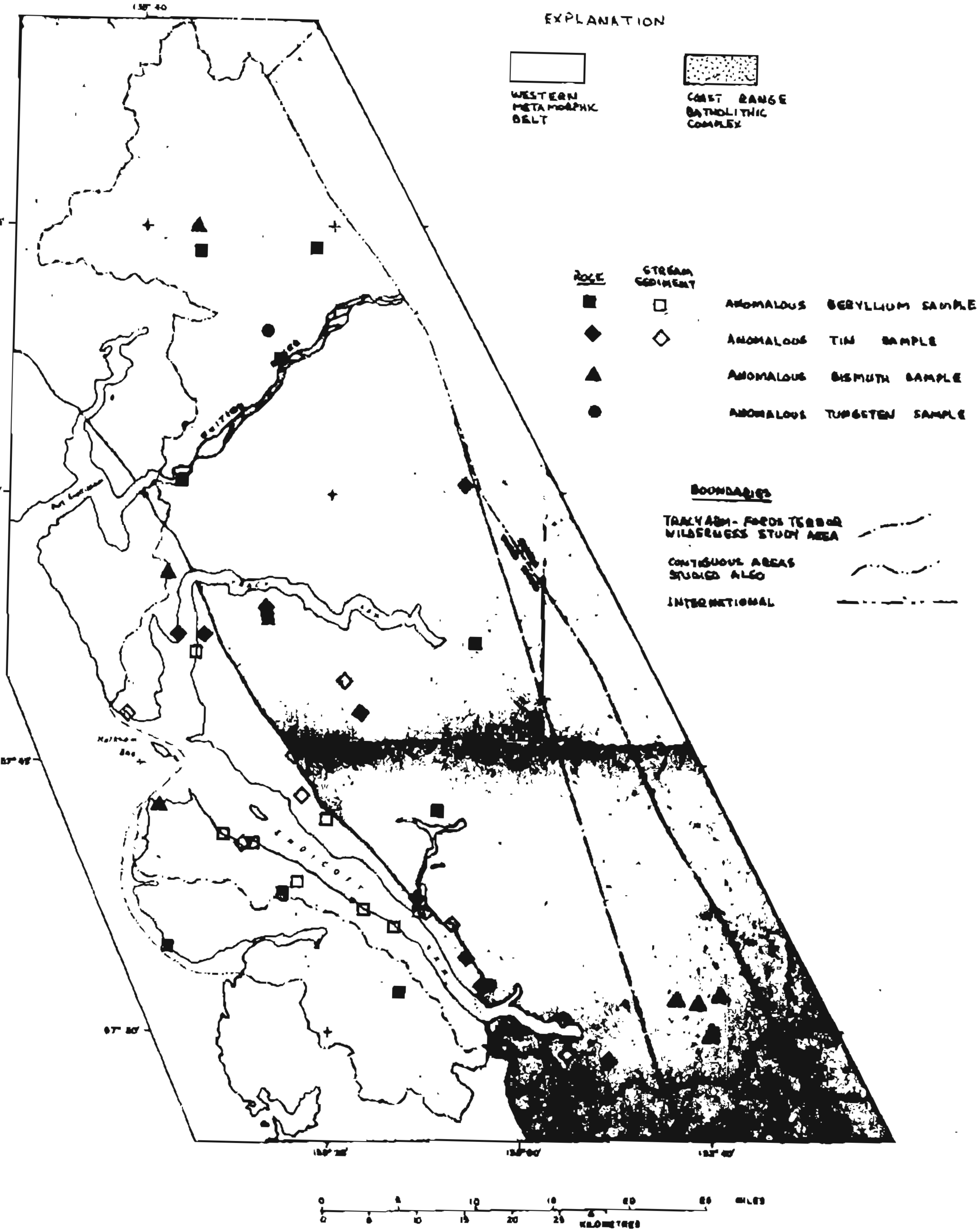

EXPLANATION
WESTERN METAMORPHIC BELT
COAST RANGE BATHOLITHIC COMPLEX
ROCK
STREAM SEDIMENT
ANOMALOUS BERYLLIUM SAMPLE
ANOMALOUS TIN SAMPLE
ANOMALOUS BISMUTH SAMPLE
ANOMALOUS TUNGSTEN SAMPLE
BOUNDARIES
TRACY ARM - FORDS TERROR WILDERNESS STUDY AREA
CONTIGUOUS AREAS STUDIED ALSO
INTERNATIONAL
MILES
KILOMETRES

Figure 22.

Figure 22.--Location of anomalous beryllium, tin, bismuth and tungsten in rocks and stream sediments, Tracy Arm-Fords Terror Wilderness Study Area.

Uranium and thorium

There has been no production of uranium or thorium from this area nor is there any prospect that contains either in substantial quantity. Because so little was known about the content of uranium and thorium in the rocks of this area, 243 rock samples were selected at random from those collected in the southern two-thirds of the area and analyzed by neutron activation analysis. Only 212 of the analyses were acceptable; they are presented in table 10.

TABLE 10 NEAR HERE.

In addition, all the rock and stream sediment samples were routinely scanned with a scintillation counter; none were significantly above background.

Figure 23 indicates the location of 38 samples with a uranium

Figure 23 near here.

content of 5 ppm or more or a thorium content of 15 ppm or more. Most of these rocks occur in the Coast Range batholithic complex, as might be expected. Granitic rocks and associated gneisses and migmatites generally have the highest uranium and thorium content of the common rocks. Rogers and Adams (1969a,b) indicate most silicic igneous rocks contain about 3 to 10 ppm uranium and 10 to 20 ppm thorium. Levinson (1974) indicates an average crustal abundance of 2.7 ppm for uranium and 10 ppm for thorium.

Table 10.--Location and uranium-thorium analytical data for selected bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area; and descriptions of the anomalous samples which are identified by map number. Abbreviations used for rock type in the sample descriptions are: AK=alaskite, AM=amphibolite, AN=andesite, AP=aplite, GD=granodiorite, GN=gneiss, GR=granite, QD-quartz-diorite, QM=quartz monzonite, QZ=quartzite, SC=schist, ZO=zone

Map No.	Field No.	UTM		PPM	
		X-coordinate	Y-coordinate	U	Th
	73DB140A	588575	6390850	0.359	B
	73DB149A	603600	6383200	2.262	10.763
	73DB152E	581075	6406075	0.429	B
	73DB156B	625675	6374375	4.644	11.666
	73DB161A	581200	6408750	0.464	B
16	73DB163E	581650	6408125	6.845	B
	73DB166A	592075	6388325	2.138	12.802
	73DB172B	615850	6370825	1.438	B
	73DB174B	616575	6372025	0.512	B
	73DB179A	618925	6373300	0.620	B
	73DB180B	618200	6373650	1.268	B
37	73DB184B	632700	6371750	2.630	17.056
	73DB188A	633150	6373500	0.925	8.188
	73DB193A	642400	6378125	3.656	6.641
	73DB201A	637450	6383450	3.956	9.388
	73DB206C	632150	6378875	2.037	5.960
	73DB230C	588400	6424025	1.199	8.127
	73DB239A	595600	6420400	0.138	1.730
12	73DB241C	597025	6419150	5.934	11.939
	73DB246A	600075	6418150	2.855	3.340
	74DB019B	577250	6429830	0.916	3.179
	74DB087A	584350	6447150	1.876	6.158
	74DB105A	602150	6383010	0.608	B
	74DB126A	590870	6386940	0.689	B
	74DB132A	594850	6386650	2.687	6.409
	74DB134A	607350	6377990	1.460	5.133
	74DB139A	606100	6377250	0.499	B
	74DB141A	611420	6372010	0.922	B
	74DB143A	610450	6371570	1.034	4.781
	74DB151A	599950	6372500	2.630	12.201
	74DB152A	607510	6373920	2.135	13.200
	74DB158C	599750	6398310	1.559	B

Table 10.--Location and uranium-thorium analytical data for selected bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area--Cont.

Map No.	Field No.	UTM		PPM	
		X-coordinate	Y-coordinate	U	Th
24	74DB162D	598370	6397580	2.683	26.027
	74DB163A	598170	6397920	2.416	12.929
21	74DB278B	622760	6405890	2.639	31.485
	74DB283A	615450	6404160	1.163	11.967
20	74DB287A	625300	6409570	0.467	27.049
	74DB294C	588060	6412800	0.271	B
	74DB297A	587000	6412270	0.347	B
14	74DB302B	609230	6418450	3.900	20.9[illegible]
	74DB306A	614040	6426640	1.410	3.1[illegible]
	74DB312C	592880	6417910	0.682	3.12[illegible]
	74DB317A	593790	6403690	2.290	7.4[illegible]
	74DB324A	589680	6408540	0.791	[illegible]
	74DB331A	581910	6421640	0.528	B
	74DB334A	583190	6423000	1.683	12.368
	74DB340C	611080	6422040	4.090	11.654
	74DB357B	599540	6429550	0.516	B
	74DB359C	603450	6428680	1.720	6.709
	74DB363D	602480	6422200	1.483	6.381
	74DB368C	598200	6427760	0.642	B
	74DB371A	611540	6429980	0.952	B
	74DB377A	607930	6427210	1.219	3.487
	74DB383B	598680	6431820	2.488	9.476
3	74DB386D	602350	6437970	9.202	54.329
	74DB388A	605600	6440130	1.105	B
	74DB392B	593750	6436240	2.308	11.889
	74DB395C	591080	6435550	2.879	6.839
4	74DB396A	590540	6434900	3.589	16.252
13	74DB401A	604800	6418260	3.231	17.884
	74DB404D	609770	6415420	4.925	13.968
15	74DB407C	608250	6415260	5.127	17.427
	74DB411A	604670	6415830	0.529	B
	74DB419B	573410	6433610	0.865	B
	74DB424D	573580	6437150	3.504	10.239
	74DB435A	605230	6444480	2.082	3.417
	74DB441A	588590	6432020	1.811	6.941
	73BC254A	580800	6403475	0.839	B
	73BC319A	601525	6386400	2.128	8.300
	73BC325A	610375	6392725	2.834	B

Table 10.--Location and uranium-thorium analytical data for selected bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area--Cont.

Map No.	Field No.	UTM		PPM	
		X-coordinate	Y-coordinate	U	Th
27	73BC331A	600675	6392400	5.003	15.034
	73BC352B	619325	6372750	0.716	3.370
	73BC363A	624175	6372950	1.004	9.648
	73BC370A	630525	6368625	1.598	B
	73BC378B	628900	6369250	1.710	4.907
	73BC397A	584650	6417600	1.175	3.824
	73BC404A	588175	6419050	0.841	B
	73BC413A	593800	6416250	1.023	3.585
	73BC423A	585200	6415775	2.955	11.329
	74CC018A	597220	6375345	2.634	7.418
	74CC025A	605040	6369170	0.252	5.590
29	74CC035A	610800	6388550	1.032	26.657
	74CC044B	641180	6370010	1.095	B
	74CC049A	599300	6401940	2.178	13.639
22	74CC053C	599750	6304000	7.177	42.400
22	74CC053D	599750	6304000	1.124	22.105
	74CC059A	592910	6400790	B	6.407
17	74CC064C	604540	6411850	1.762	21.590
	74CC072A	621800	6390440	B	6.151
	74CC072B	621800	6390440	0.806	2.853
31	74CC073B	620100	6390800	0.844	20.906
34	74CC077A	619070	6382200	1.147	32.849
	74CC086A	590840	6409240	1.551	6.528
	74CC088A	590170	6408400	2.799	10.479
	74CC093A	615200	6409200	1.253	9.167
	74CC099B	622290	6415090	0.854	4.855
	74CC109A	587820	6410360	0.668	3.001
7	74CC116C	612830	6429060	11.493	10.768
	74CC132A	589410	6412830	1.862	10.013
	74CC139B	592320	6416840	2.445	6.714
11	74CC139D	592320	6416840	3.084	40.486
	74CC196D	599350	6444250	1.331	4.549
2	74CC199A	595270	6439950	5.588	13.219
	74CC218A	577550	6414475	0.364	B
	73AF099A	611875	6379375	0.445	B
	73AF157A	614600	6376500	0.330	B
	73AF166B	613300	6396900	0.529	B
	73AF175A	610800	6393525	1.712	4.909
	73AF183A	587900	6407450	3.074	6.445
	73AF191A	581700	6390500	2.151	7.200
	73AF196C	607150	6380425	0.232	B
	73AF200B	606725	6381950	1.326	B
	73AF207A	623700	6371550	3.152	11.422
	73AF216A	621900	6373625	1.106	7.685
	73AF226A	631525	6372525	0.904	4.445
	73AF234A	621500	6380650	1.977	10.630
	73AF259A	585150	6421350	1.269	3.217
	73AF266B	591700	6420775	2.970	11.596

Table 10.--Location and uranium-thorium analytical data for selected bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area--Cont.

Map No.	Field No.	UTM		PPM	
		X-coordinate	Y-coordinate	U	Th
33	74AF076A	608550	6373100	3.988	15.246
	74AF109B	597140	6383500	1.765	6.469
	74AF258G	570300	6411450	0.301	B
	74AF258I	570300	6411450	2.496	4.709
	74AF258J	570300	6411450	3.739	10.127
	73DG235A	592425	6387125	1.461	3.260
26	73DG243A	595650	6388950	2.255	17.696
	73DG253A	608675	6390050	2.044	5.566
	73DG261A	609950	6395750	2.833	5.686
	73DG281A	605875	6388700	1.440	4.142
28	73DG290A	608850	6389200	6.234	18.092
	73DG297A	511375	6374550	2.337	11.370
	73DG307A	613825	6371025	0.691	B
	73DG315A	611800	6375150	1.800	7.013
	73DG323B	613100	6372375	B	2.030
33	73DG329B	634250	6368725	2.874	20.007
	73DG335A	629350	6371800	1.656	B
	73DG340A	628650	6370275	0.196	B
36	73DG348B	629175	6378050	8.879	31.866
	73DG358C	625950	6376650	3.677	B
	73DG375A	583625	6421275	1.516	B
	73DG382A	582875	6417500	1.311	B
	73DG399B	582700	6413700	1.853	5.981
	73DG400A	578325	6413450	0.254	B
	73DG413A	601300	6417950	2.455	12.998
	74DG066A	578180	6433300	1.327	6.750
	74DG075A	586190	6440620	1.339	4.518
	74DG129A	604850	6379980	1.764	8.463
	74DG131C	603840	6380540	2.312	12.556
	74DG166A	598370	6384840	2.511	13.954
	74DG171B	594940	6383850	0.466	B
	73BL004A	601850	6386775	4.465	B
	73BL012A	638450	6378075	3.664	10.767
	73BL019A	633225	6379825	4.760	7.695
	74CN042A	602250	6383090	0.776	B
	74CN047A	598600	6386670	1.529	4.888
32	74CN051A	607360	6378210	8.873	33.357
	74CN056A	593450	6381310	3.679	8.665
	74CN071B	602210	6394420	0.750	2.141
	74CN076B	627600	6380800	0.517	4.697
	74CN084A	637720	6387710	3.309	10.298
	74CN089B	606970	6407670	1.243	13.226
18	74CN093D	612550	6410570	1.635	20.783
25	74CN097A	582000	6389010	3.044	15.092
23	74CN100D	607170	6302300	3.614	22.043
	74CN104B	603250	641[illegible]50	1.365	6.006

Table 10.--Location and uranium-thorium analytical data for selected bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area--Cont.

Map No.	Field No.	UTM		PPM	
		X-coordinate	Y-coordinate	U	Th
30	74CN111A	612310	6389650	1.568	18.157
	74CN117B	612840	6392850	1.683	2.187
	74CN123B	615050	6382450	3.090	7.174
	74CN128A	618160	6393030	0.184	B
	74CN130A	592010	6404200	2.264	3.797
	74CN136C	614150	6404760	2.333	3.108
19	74CN138C	613900	6407300	3.057	22.257
	74CN142B	623660	6411400	2.031	3.552
	74CN147B	618450	6418150	4.271	7.947
	74CN150E	615960	6416010	2.389	6.469
	74CN152D	615200	6413760	0.833	B
	73SN015A	625100	6372750	1.537	11.118
	73SN032A	586275	6417250	1.594	9.988
	74WV006A	578050	6428800	2.072	B
	74WV017A	580680	6435010	1.441	11.277
1	74WV022B	589105	6442740	11.755	23.415
	74WV025B	596660	6415800	1.939	B
	74WV031A	594740	6407140	1.346	8.289
	74WV048A	589650	6385700	2.560	7.800
	74WV062B	614750	6366900	0.770	B
	74WV066A	595400	6379180	3.492	11.274
	74WV153B	581190	6389190	1.010	2.351
	74WV158B	579210	6388295	2.327	B
	74WV162B	612900	6405380	4.644	6.292
	74WV168A	588850	6370750	0.571	B
	74WV172A	585660	6373800	1.304	B
	74WV180B	627060	6398310	2.586	B
35	74WV184B	623550	6383400	2.796	16.844
	74WV188A	609820	6396700	1.210	4.889
	74WV194B	617410	6397550	0.542	B
	74WV200C	621010	6406300	1.524	9.247
	74WV252B	607020	6414800	0.673	B
	74WV256D	602525	6415140	1.460	5.556
8	74WV261A	602450	6424900	7.961	18.920
9	74WV262A	601260	6422685	3.915	43.061
	74WV273A	590940	6426595	0.224	B
	74WV277A	588160	6422690	1.895	B
	74WV287A	592800	6432945	0.531	B
5	74WV289D	593055	6434500	6.285	10.216
	74WV293A	599865	6434550	1.522	6.242
6	74WV296C	597515	6435050	7.725	B
10	74WV298A	601600	6420710	2.260	21.660
	74WV307A	575500	6429690	2.515	14.443
	74WV315A	597600	6446000	1.751	11.168
	74WV324A	599500	6439925	1.022	6.098
	74WV336A	571860	6437340	0.428	B
	74WV341A	606045	6445225	2.545	11.718
	74WV347A	587795	6431595	0.902	6.467

Table 10.--Location and uranium-thorium analytical data for selected bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror Wilderness Study Area--Cont.

Map No.	Field No.	Rock type	Background sample, no visible sulfides	Fe stain present	Visible sulfides	Other
1	74WV022B	AP			X	
2	74CC199A	GD	X			
3	74DB386D	GD	X			
4	74DB396A	GN	X			
5	74WV289D	AK	X			
6	74WV296C	GN	X			
7	74CC116C	GN	X			
8	74WV261A	GD	X			
9	74WV262A	GN	X			
10	74WV298A	GN	X			
11	74CC139D	GN	X			
12	73DB241C	AP	X			
13	74DB401A	GR	X			
14	74DB302B	GN		X		20 1X5 m
15	74DB407C	AK	X			
16	73DB163E	PH	X			
17	74CC064C	GN	X			
18	74CN093D	BG	X			
19	74CN138C	UP		X		
20	74DB287A	GR	X			
21	74DB278B	GR	X			
22	74CC053C	GN	X			
	74CC053D	GN	X			
23	74CN100D	GN		X		
24	74DB162D	SC		X		20 2-[illegible] thick
25	74CN097A	PH	X			
26	73DG243A	AM	X			
27	73BC331A	SC	X			
28	73DG290A	GD	X			
29	74CC035A	QD	X			
30	74CN111A	AN	X			
31	74CC073B	GN	X			
32	74CN051A	SC	X			
33	74AF076A	QZ	X			
34	74CC077A	QM	X			
35	74WV184B	GN	X			
36	73DG348B	GN		X	X	
37	73DB184B	SC	X			
38	73DG329B	GN		X		

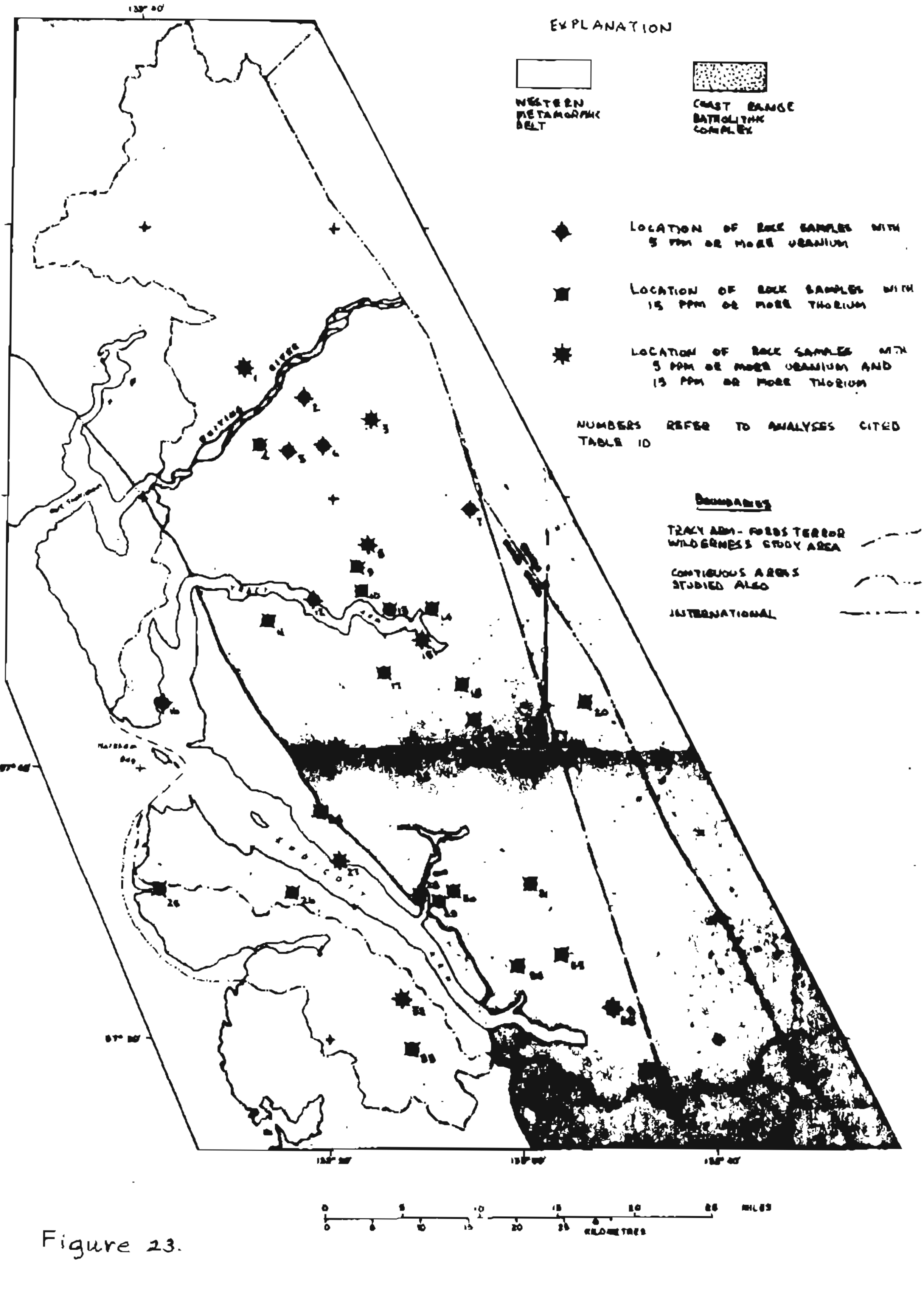

EXPLANATION
WESTERN METAMORPHIC BELT
COAST RANGE BATHOLITHIC COMPLEX
LOCATION OF ROCK SAMPLES WITH 5 PPM OR MORE URANIUM
LOCATION OF ROCK SAMPLES WITH 15 PPM OR MORE THORIUM
LOCATION OF ROCK SAMPLES WITH 5 PPM OR MORE URANIUM AND 15 PPM OR MORE THORIUM
NUMBERS REFER TO ANALYSES CITED TABLE 10
BOUNDARIES
TRACY ARM - FORDS TERROR WILDERNESS STUDY AREA
CONTIGUOUS AREAS STUDIED ALSO
INTERNATIONAL
MILES
KILOMETRES

Figure 23.

Figure 23.--Location of anomalous uranium and thorium in rocks and stream sediments, Tracy Arm-Fords Terror Wilderness Study Area.

The maximum uranium value in any sample from the area is less than 12 ppm and the maximum thorium value is less than 55 ppm. The mean uranium content of all the rocks analyzed is 2.2 ppm, and the mean thorium content is 11.4 ppm. The samples thus include only a few above the usual background range of either uranium or thorium and the average content in the area is essentially the average crustal abundance. The samples analyzed during this study indicate that the area is probably lacking in significant uranium and thorium mineralization. The sampling indicates almost no potential for a large low-grade uranium-thorium resource of the Conway Granite-type although small vein-type deposits may be present and as yet undetected.

Relationships of trace elements in rocks

The analytical data were treated statistically to determine the correlation coefficient for each pair of elements. The correlation coefficient for any pair of elements indicates how closely their relationship approximates a positive or negative linear function. Thus a correlation coefficient of 1 indicates that as the amount of one element increases, the other increases in a set ratio, i.e., if all the analyses for two elements are plotted on a graph all the data points could be connected by a straight line.

The correlation matrix in table 11 is a measure of the relations

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TABLE 11 NEAR HERE.

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between the trace elements in the rocks of the area. The matrix is based on all the 4,428 analyses of the rocks collected in the geochemical phase of this study. The limits of detection for each element determine whether it will be likely to form a data pair, thus correlations that have a large number of data pairs indicate that both elements are generally above the detection limit. Few of the correlation coefficients shown on table 11 exceed 0.5; this is at least partly due to the great diversity of rock types and mineralized samples collected during this study.

Table 11.--Correlation matrix for trace elements in rocks (4,428 samples).

Number of data pairs shown in parenthesis beneath the correlation coefficients.

Detection limits for each element shown in parenthesis along the abscissa.

All analyses by semiquantitative spectrographic methods except gold, copper, mercury, lead, and zinc which are by atomic absorption methods.

	Ag	Au	B	Ba	Be	Co	Cr	Cu	Fe	Hg	La	Mo	Nb	Ni	Pb	Sc	Sn	Sr	V	Y	Zn	Zr
Ag	Ag																					
Au	0.5686 (9)	Au																				
B	-0.1408 (164)	0.0586 (15)	B																			
Ba	-0.1966 (218)	0.1464 (31)	-0.0019 (554)	Ba																		
Be	0.0432 (161)	-0.0732 (19)	0.0468 (616)	-0.0117 (2334)	Be																	
Co	0.0393 (228)	-0.1571 (26)	0.0264 (566)	-0.2421 (3651)	-0.0186 (2175)	Co																
Cr	0.0215 (225)	-0.1066 (21)	0.1096 (540)	[illegible]	0.1112 (1363)	0.5079 (2659)	Cr															
Cu	0.3571 (108)	0.0418 (30)	0.0167 (569)	-0.1381 (2584)	-0.0147 (1640)	0.4516 (1461)	[illegible] (1998)	Cu														
Fe	-0.0628 (231)	-0.2214 (51)	[illegible] (627)	[illegible] (4071)	[illegible] (2404)	[illegible] (5676)	0.1951 (2604)	0.0179 (3351)	Fe													
Hg	0.1648 (171)	0.1117 (12)	-0.0512 (364)	-0.0170 (2146)	[illegible] (1376)	0.0255 (2048)	0.0280 (1469)	0.2569 (1759)	-0.0120 (1314)	Hg												
La	0.1316 (153)	0.1520 (16)	0.1910 (344)	[illegible] (2326)	0.1756 [illegible]	-0.0568 (2131)	-0.0268 (1459)	-0.0373 (1717)	0.0042 (2498)	-0.0017 (250)	La											
Mo	0.0284 (110)	[illegible] (5)	-0.0692 (159)	-0.1990 (462)	-0.0171 (311)	-0.0218 (409)	-0.0266 (541)	0.0218 (402)	0.0407 (466)	0.0601 (226)	-0.0766 (801)	Mo										
Nb	0.1860 (22)	[illegible] (7)	0.2623 (53)	0.0013 (196)	[illegible] (145)	0.0866 (193)	-0.0181 (161)	0.2896 (164)	0.0532 (209)	0.4239 (104)	0.9130 (183)	0.1169 (91)	Nb									
Ni	-0.0381 (246)	-0.1157 (27)	-0.0124 (585)	-0.1136 (3349)	-0.0136 (1468)	0.4637 (3423)	0.8640 (2698)	-0.0649 (2433)	0.1428 (5586)	0.0130 (1571)	-0.1017 (1916)	-0.0173 (425)	[illegible] (181)	Ni								
Pb	0.6325 (234)	0.4681 (24)	-0.0136 (527)	-0.0973 (3858)	0.0010 (1852)	-0.0145 (2982)	-0.0040 (2217)	0.1391 (257)	-0.0215 (3274)	0.1024 (1765)	-0.1016 (1847)	-0.0049 (384)	0.0479 (176)	[illegible] (2744)	Pb							
Sc	-0.0621 (248)	0.3493 (30)	0.0527 (603)	-0.2372 (3658)	-0.0147 (2178)	0.3575 (2261)	0.1231 (2702)	0.3166 (3068)	0.4611 (3977)	-0.0571 (2058)	-0.0930 (2130)	0.0079 (449)	-0.1274 (208)	-0.0219 (3495)	-0.0253 (2497)	Sc						
Sn	0.1582 (11)	[illegible] (8)	-0.2856 (19)	-0.0648 (91)	[illegible] (16)	-0.0769 (39)	-0.0118 (32)	-0.1925 (36)	0.5978 (44)	-0.2247 (17)	0.3588 (31)	0.1811 (11)	0.0467 (11)	-0.0586 (40)	-0.0077 (35)	0.2540 (40)	Sn					
Sr	0.0167 (304)	0.2115 (27)	0.1527 (479)	0.2277 (3628)	-0.0257 (2308)	-0.0711 (3460)	-0.1371 (2486)	-0.0125 (2921)	0.0497 (3980)	-0.0175 (2617)	0.0554 (2229)	-0.0456 (384)	0.0275 (191)	-0.1368 (5093)	-0.0044 (2866)	-0.1917 (3981)	-0.1284 (32)	Sr				
V	-0.0654 (268)	-0.1260 (31)	0.0101 (657)	0.1655 (4064)	-0.0335 (2346)	0.1862 (5831)	-0.0575 (3748)	0.0096 (5280)	0.2891 (4295)	-0.0140 (3269)	-0.0615 (2591)	[illegible] (402)	-0.1554 (203)	-0.0522 (5538)	-0.1487 (3262)	0.3481 (4866)	-0.0958 (44)	-0.0653 (5780)	V			
Y	0.0356 (232)	-0.2163 (27)	0.0009 (589)	-0.0477 (3651)	0.0396 (2242)	0.1555 (5578)	0.0100 (2606)	0.0091 (3027)	0.2112 (3861)	-0.0126 (2044)	0.1532 (2253)	0.0931 (430)	0.4096 (202)	0.0340 (3343)	0.1044 (2453)	0.2724 (2253)	-0.2014 (41)	-0.0362 (3503)	0.1724 (3816)	Y		
Zn	0.5270 (266)	0.0228 (32)	0.0127 (638)	0.0167 (3963)	-0.0447 (2574)	-0.0443 (2804)	-0.0544 (2727)	0.2200 (3245)	[illegible] (4260)	0.1019 (2284)	-0.0075 (2369)	0.0573 (455)	-0.0154 (207)	[illegible] (3984)	0.1975 (3216)	-0.0443 (3820)	-0.0656 (43)	-0.0628 (3765)	0.1984 (4173)	0.0903 (3804)	Zn	
Zr	-0.0410 (1364)	-0.1415 (29)	0.1191 (638)	0.1567 (4021)	0.0591 (2548)	-0.1017 (3862)	-0.1323 (2740)	0.1366 (3829)	0.1232 (4246)	[illegible] (2281)	0.1792 (2594)	0.0491 (457)	0.5656 (208)	-0.0729 (3483)	0.0071 (3178)	0.1711 (3826)	[illegible] (44)	0.0398 (3785)	[illegible] (4137)	0.2474 (3841)	0.0076 (4054)	Zr
	Ag (0.5)	Au (0.1)	B (10)	Ba (20)	Be (1)	Co (5)	Cr (10)	Cu (5)	Fe (500)	Hg (0.02)	La (20)	Mo (5)	Nb (20)	Ni (5)	Pb (10)	Sc (5)	Sn (10)	Sr (100)	V (10)	Y (10)	Zn (10)	Zr (10)

	>50 pairs	<50 pairs
Coorelation coefficient of >0.3 or <-0.3	solid box with X	dashed box with X
Coorelation coefficient of 0.15 to 0.299 or -0.15 to -0.299	solid box	dashed box

The trace element relationships in this area are considered as 1) those that are related to the usual geochemical relationships in rocks and, 2) those that may be related to mineralization. Pairs of elements with correlation coefficients above 0.3 or below -0.3 are probably interrelated. Thus the association of chromium, cobalt, and nickel is a basic geochemical relationship that is characteristic of ultramafic rocks and in this area, as elsewhere, persists through the geochemical cycle. Similarly, the relationship of niobium to beryllium, lanthanum, yttrium, and zirconium, and to a varying extent each of these to each other, represents a basic geochemical association that is reflected in Goldschmidt's (1954) lithophile group of elements.

Among the correlations of potential economic significance in this area are those of silver with gold, lead, and zinc; of gold with lead and silver; of copper with silver; and of lead with silver and gold. These elements are grouped by Goldschmidt (1954) as the chalcophile elements. They show poor correlation with all the other elements in the rocks, suggesting that the deposits that contain copper, lead, zinc, silver, and gold in this area are not directly related to the rocks of the area but represent a distinct mineralization event. In contrast, the correlation of tin with beryllium and lanthanum as well as beryllium with other lithophile elements suggests a relationship to the silicic igneous rocks of the Coast Range batholithic complex. The remaining strong correlations--scandium with cobalt and iron; molybdenum with vanadium; and scandium with cobalt, iron and vanadium--are obscure mainly because one or another of these elements is either ubiquitous (as in the case of iron) or occurs in a variety of geochemical roles.

The degree of correlation for pairs of elements with correlation coefficients between 0.15 and 0.299 or -0.15 and -0.299 is so low that any interpretation is suspect. Some--notably copper with mercury and zinc, lead with zinc, or zinc with copper and mercury--represent a chalcophilic association known from numerous mineral deposits throughout the world. Others--for instance, chromium with barium or yttrium, probably represent some basic geochemical trend but the relationships are speculative. Some of the relationships marked by low correlation coefficients might show much stronger affinity if the population was not so large and diverse. However, others might prove to have even lower affinity if the population were subdivided further.

Mineral resources

By Arthur L. Kimball, Jan C. Still and Jeanne L. Rataj

Introduction

Geologic relations

Mineralization within and near the study area lies almost entirely in the southern part of the Juneau gold belt which extends from north of Berners Bay southeastward through Juneau to Port Houghton. This belt follows the metamorphic rocks that parallel the southwest side of the Coast Range batholithic complex. The majority of mineralization occurs in two zones: 1) on the Endicott Peninsula between Point Astley and Windham Bay, and 2) in the narrow Sumdum Glacier mineral belt on the east margin of the metamorphic rocks extending from Lower Sweetheart Lake southeastward to Spruce Mountain opposite the mouth of Fords Terror.

The Endicott Peninsula produced about 25 thousand ounces of gold from narrow quartz veins in graphitic limestone, phyllite and greenschist between the now abandoned mining towns of Sumdum and Windham. The genesis of these deposits is uncertain, however it may be linked with nearby felsic rocks which have intruded the low-grade metamorphic rocks (pl. 1). A silver-bearing copper-zinc prospect on Point Astley had some early development, but no production. Disseminated grains and lenses of sphalerite, chalcopyrite, galena, and traces of bornite and tetrahedrite generally following foliation are distributed erratically over several acres; the sulfides probably were metamorphosed simultaneously with the enclosing muscovite-quartz-feldspar schists.

The Sumdum Glacier mineral belt is characterized by copper-zinc-gold mineralization with minor lead values. Copper, zinc, and a little silver dominate the deposits in the central and southeastern portions of the belt. The major deposits in this part of the belt are the Tracy Arm zinc-copper deposit and the Sumdum copper-zinc prospect. Pyrrhotite, pyrite, chalcopyrite and sphalerite occur as disseminated grains and as lenses parallel to the foliation of the metamorphic rocks in which they occur. These minerals developed metamorphic texture and structure coincident with the development of the foliation.

The Sweetheart Ridge prospect, located at the north end of the belt and discovered during this investigation, also parallels the foliation of the metamorphic rocks but differs from the above two prospects in that both gold and copper dominate. Alteration varies from almost none in the northwestern end of the belt to a pervasive alteration product of the greenschists and phyllites near the southeastern end of the belt to sericite. Surface staining occurs widely throughout the belt.

The Snettisham ultramafic body just west of the study area, developed as an iron deposit, but which is now dormant, is one of the magnetite-rich "zoned" or "Alaska"-type ultramafics that occur in a belt throughout southeastern Alaska (Taylor and Noble, 1969). Another ultramafic body which is poorly exposed near the head of Windham Bay has long been known (Buddington, 1929, pl. 2). Although its magnetic anomaly is less prominent than that of the Snettisham anomaly, and surface sampling during this study did not indicate economic mineralization, the potential of this body is not fully known.

Previously known mineralization within the Coast Range batholithic complex is restricted to a single silver prospect south of the Whiting River. The geochemical anomalies that were investigated did not indicate significant additional mineralization within the batholithic complex.

Exploration by prospectors and mining companies in this area undoubtedly varied in its thoroughness. Generations of prospectors, fishermen and boatmen have seen coastal exposures, and most geologic work prior to this study has concentrated near the shoreline. Mineralization occurs mainly in heavily timbered areas characteristic of the metamorphic rocks where topographic relief is less extreme than in the Coast Range batholithic complex. Although these timbered areas have been prospected, the thick cover does not allow a clear view of mineralization. Most of the known prospects and mines are poorly exposed at best. Mineralization at some prospects is now visible only in open cuts, trenches and underground workings. Two deposits, the Tracy Arm zinc-copper deposit and the Sumdum Chief lode gold mine from which nearly all production came, are geochemically and visually obscure and would likely not have been discovered during this investigation. The Sumdum copper-zinc prospect on the other hand, at higher elevation and with better exposure, probably would have been discovered during this study had it not already been known.

There is little or no history of prospecting in the high terrain of the Coast Range batholithic complex nor of systematic geologic work within this area. The formidable terrain, extreme snowfall, poor weather and the lack of natural avenues of approach have kept it inaccessible until recently when dependable helicopters were developed. This study would probably have been impossible in any reasonable time or with adequate detail without the use of helicopters.

Production

The area investigated produced about 27 thousand ounces of gold and several thousand ounces of silver as determined from the literature and by inference based on field investigation. The original study area proper produced 90 to 95 percent of this; the remainder came from the 88 thousand acres to the southwest here called the Windham Bay addition.

The Sumdum Chief gold mine, made up of two gold veins known as the Sumdum Chief and the Bald Eagle, near the abandoned town of Sumdum in the Sanford Cove area, produced nearly 24 thousand ounces of gold and probably the same amount of silver before closing in 1904 (Spencer, 1906). This accounted for most of the production from the study area. Spencer (1906) noted also that nearly two thousand ounces of placer gold were reported to have been produced from Powers Creek and Windham Bay (probably Spruce Creek) in 1870 and 1871, just after gold was discovered in the region. How much of this came from Powers Creek within the study area proper cannot be determined. The only additional reported production was some 50 ounces of lode gold from the Jensen mine near Spruce Creek reported by Willis (1926 and 1927), and another lot of less than 50 ounces attributed by old records to the same area.

Field examination of old workings suggests that some additional lode and placer gold has been produced, but the production records are not available. At least 25 openings having a combined length of nearly 1 mile of underground workings have been driven in search of gold in addition to the Sumdum Chief mine. Sampling during this study shows sufficient gold value in a few of the smaller workings to indicate that some gold was probably produced from them. At least five mills for concentrating gold ores were installed in addition to the Sumdum Chief mill. Their sketchy history, however, suggests probably none but the latter operated for more than a season or two. Placer gold production other than that reported for 1870 and 1871 is not recorded; however, placer mining was pursued intermittently until after 1950.

Methods of evaluation

Mining claim records of the Juneau recording precinct were searched, and technical publications and literature were examined before field investigation began. Information was also obtained from people having special knowledge of the area to be studied. In the field prospects and workings were sampled, mapped and studied in detail. All mining claims which could be found were examined. Stained and altered zones were also investigated, some previously known and others identified during this study. Several sites of geochemical rock and stream sediment samples having especially high metal values or an unusual association of metallic elements were also examined.

Search for prospects and claims was conducted by helicopter, on foot and by small, powered skiff. Many miles were traveled on foot in search of claims and prospects, especially in the forested areas. Few claims could be identified on the ground. Occasional workings were found which could not be correlated with the available data. Some prospects referred to in literature could not be found. The Sumdum Chief gold mine, which has been dormant for over 70 years and the only significant producer in the area studied, was found only after extensive foot search.

Sampling

Sample types

Nearly 1,300 quantitative rock samples were obtained from veins, mineralized zones, altered or stained areas, dumps, pits, mines and prospects examined. Samples were of four types: 1) channel samples--carefully moiled, uniform, continuous cuts of measured length; 2) chip samples--uniform sized chips in a continuous line of measured length; 3) spaced-chip samples--uniform sized fragments taken at uniform interval or spacing along a measured line; and 4) composite grab samples--random fragment composite from an estimated or measured area. Selected samples were taken to establish mineralogy, rock type and genesis, while others were taken to determine ore grade by quantitative analysis.

Pan concentrates were obtained of formerly placered stream gravels and were analyzed for gold.

Analytical tables

Tables of analytical results which accompany individual prospect descriptions in the text, report sample values for no more than nine elements. These elements, as well as the lower limits of detectability for quantitative measurability for these elements, are given in table 12.

TABLE 12 NEAR HERE.

An exception to this is table 20.

Analyses for mercury by mercury vapor detector and analyses for 22 additional elements by semiquantitative spectrographic analysis did not indicate significant values, therefore they are not reported in the tables of this publication. These data are available through National Technical Information Service (NTIS) (Forn and others, 1977).

The letter "L" used in reporting sample analysis of the nine elements means that the element was detected but was below the limit of quantitative determination. The letter "N" indicates that the element was looked for but was not detected.

Measurement

Vein and sample widths and other field measurements were made in English units. English units have been retained in the Mineral Resources section of the text whereas both English and metric units are given in many analytical tables. Since measurements were in English units, to use the metric "equivalent" alone would imply either a greater or lesser precision than that of the original measurement.

Table 12.--Limit of quantitative determination for elements listed in tables 13 through 37

Semiquantitative spectrographic analysis		Atomic absorption analysis		Fire assay	
silver	0.5 ppm	copper	5 ppm	gold	0.15 ppm
cadmium	20 ppm	lead	5 ppm	silver[1/]	>0.15 ppm
arsenic	200 ppm	zinc	5 ppm		
molybdenum	5 ppm	gold	0.5 ppm		
nickel	5 ppm				

[1/] The limit of quantitative determination for silver is somewhat greater than for gold.

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Mining claims

The records in the Juneau recording precinct dating back to 1880 indicate that about 670 mining claims have been located within the area. Ninety percent of these were lode claims. The total number of claims is probably greater since gold mining began in the area nearly 20 years earlier. Claim location descriptions, although not always clear, indicate generally that about 480 of the listed claims are within the study area itself and the remaining 190 in the Windham Bay addition. Most placer claims are situated in this addition. There were 97 known active claims in the area in 1975 (pl. 3). Those were 62 Sumdum Chief (copper) claims near Sumdum Glacier, three Sunny Day claims on Point Astley, four Iceburg claims on the former Sulphide prospect, the 24 Tracy claims covering the Tracy Arm zinc-copper prospect, and four Arm claims to the north across Tracy Arm.

Thirty lode and four placer claims were patented before 1919. Seven patented lode claims situated within the study area proper are now held by the State of Alaska and include the patented claims of the Sumdum Chief gold mining property. All other patented claims are privately owned. All but one are situated near the head of Windham Bay either adjacent to the beach or in the lower valley of Spruce Creek and are in the Windham Bay addition to the area. Fifteen lode and four placer claims, of the 26 that belonged to the State of Alaska through tax foreclosure, were sold (with one mill site) at public auction in 1972 for more than $100,000.

Most claims were located more than 50 years ago. Many cannot be found, either because marks on the ground are obliterated or because their location descriptions are inadequate. Claim locations were often tied to a natural feature or cabin that had a local name which has not been preserved. Some claims probably were never revisited after the year located; others relocated former claims. The Point Astley prospect was relocated at least six times in 75 years.

Economic considerations

There are many factors that influence the mining of a mineral deposit. The following is a very brief discussion of some of the factors that can affect mining in the study area.

The deposits of the area are narrow, steeply dipping zones with competent wall rock. They could probably best be mined by underground methods. All lie within 2 miles of deep saltwater fiords. Abundant water and timber are available. Their mineralogy might allow simple metallurgical processing. Revegetation over mine waste should be rapid at lower elevations. Among the potential liabilities to mining are the severe winters, heavy snowfall, and the lack of permanent population in the area. Additional considerations include the lack of skilled miners, increasing stringency of government regulations which affect local timber supply, and land acquisition problems which may arise.

Present mining costs in Alaska are nearly twice those of comparable metal mining in the contiguous 48 states. A somewhat smaller differential may apply in southeastern Alaska. For a 100,000-ton deposit in this area it is estimated that the minimum value of the ore has to be $50 to $75 per ton before it can be economically developed. Lower costs might be obtained if larger ore bodies are present. Future advances in mining technology could reduce the minimum grade required to mine in this area.

In the following sections we describe deposits in the rudimentary terms of apparent approximate dimensions and grade. All tonnage calculations are estimates. In one instance it was possible to arrive at some range in tonnage and grade which was converted to total combined metal value at today's metal prices. The dimension and grade was inferred from selected available information to provide an overall picture of the deposit. Since no additional exploratory information is available judgment can be used to adjust the tonnage and(or) grade figures. Normal stoping width is not less than 4 feet wide. To determine minable material high assay veins of narrow widths are distributed over a 4-foot width.

Point Astley prospect

A zinc-silver prospect at Point Astley has been known since the turn of the century. First located as the Oceanic Group, the property was operated by the Oceanic Mining Company and later, before 1920, by the Alaska Copper Mining Company. Variously known as Point Astley, Alaska Ventures, Lucky Venture, and Smudge between 1923 and 1957, it was again relocated as three Lucky Star claims in 1968 and is presently active. A smelter-test shipment was reported before 1925 (Ahrenstedt, 1928). From early descriptions of the property by Spencer (1906) and Buddington (1923), it is apparent that there has been little or no physical development for many years. More recently, the prospect was examined by Banister in 1962 (unpub. report) and by Herreid and Race (1962). Information from each of these examinations is incorporated in the present study.

The deposits consist of disseminated sulfides and massive sulfide lenses usually not more than a few feet in length parallel to foliation in chlorite phyllite and schist. Sulfides are mostly pyrite and sphalerite with lesser amounts of galena and occasional chalcopyrite. In the most highly mineralized areas some bornite and chalcocite as well as covelite and digenite are present. Two zones of mineralization were examined; one to the northwest in the vicinity of an inclined and vertical shaft, and the other to the southeast in the vicinity of Adit #1 and Adit #2 (figs. 24 and 25). The zones are separated by 700 feet of beach

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Figures 24 and 25 near here.

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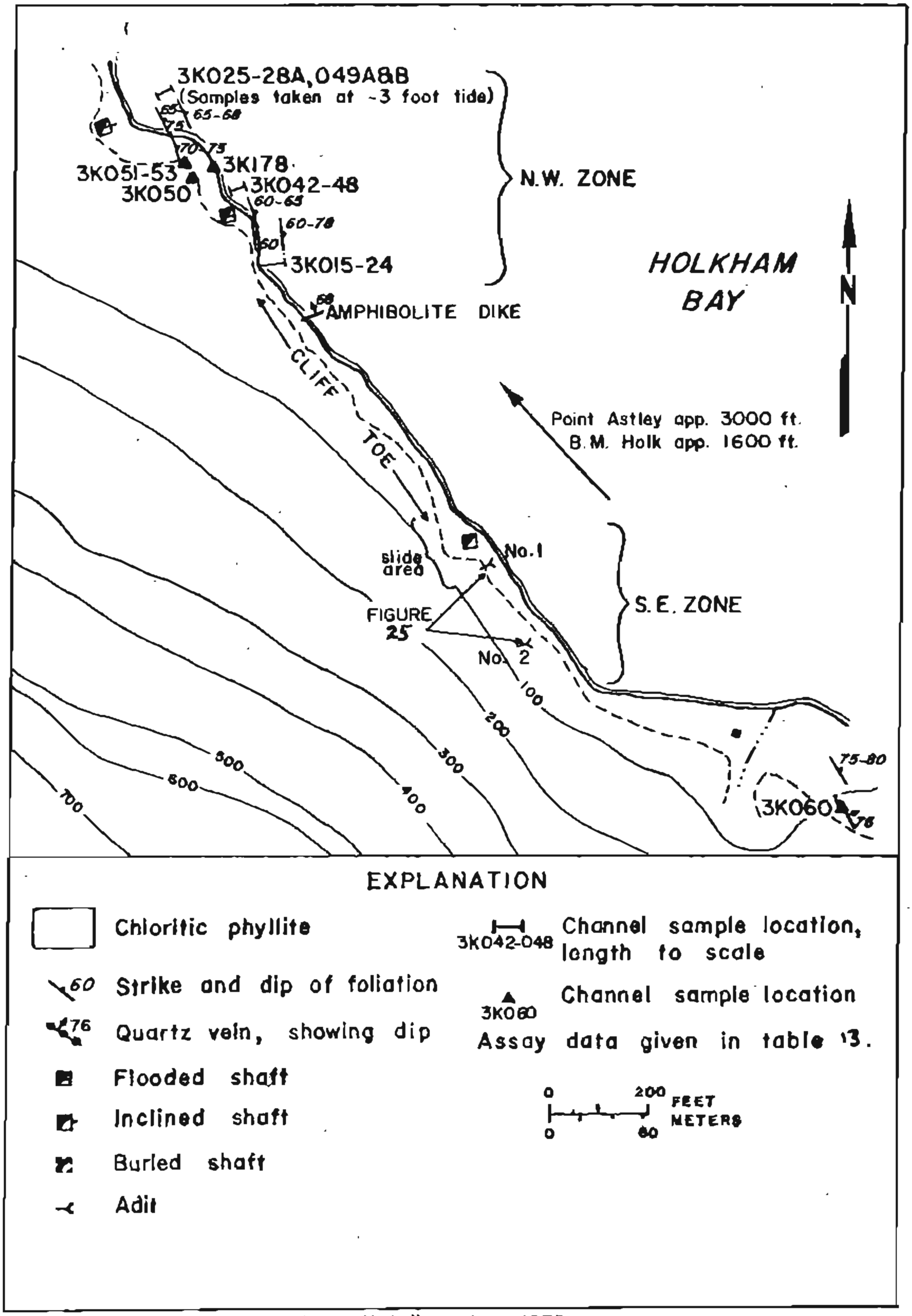
apparently barren of mineralization

Channel samples were taken across the mineralized structure in each of the adits and of mineralized outcroppings in the intertidal zone (table 13). The sample sites reflect areas of the most prominent

TABLE 13 NEAR HERE.

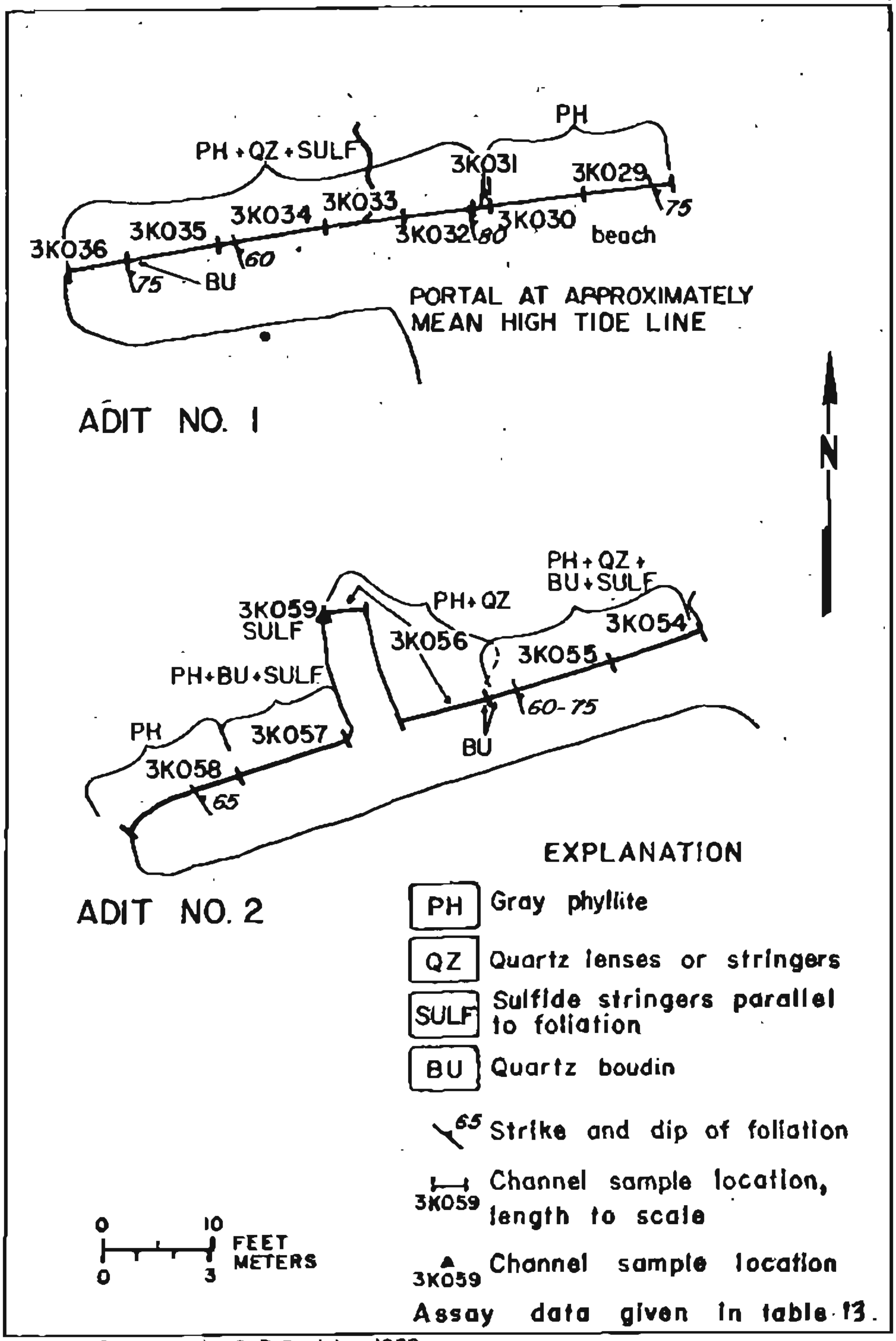
mineralization seen. Sediment samples were also collected from a nearby stream. The zone to the northwest is exposed on the wave-cut bench at low tide, seaward of two shafts. Both shafts are flooded and inaccessible. Crosscuts from these shafts were reported to have been driven northwest to the vein structure before 1925 (Buddington, 1925). The northwesterly trending mineralized zone was sampled at three sites on the wave-cut bench spaced over a distance of 400 feet; however, it was not defined clearly enough to be traced from one sample site to the next. At the northernmost site samples were taken across a 10-foot section at extreme low tide on the wave-cut bench 150 feet northeast of the inclined shaft. The samples' weighted average value was 0.48 percent copper, 0.11 percent lead, 1.65 percent zinc and 0.2 ounces silver per ton (table 13). These represent the highest values obtained across a significant width. Isolated high values were obtained from a massive, narrow sulfide zone. For example, sample 3K178, cut across a 1.1-foot-thick massive pyrite and sphalerite zone, gave 0.44 percent copper, 0.31 percent lead and 9.0 percent zinc with values of 0.17 ounces gold per ton and 1.45 ounces silver per ton.



Mapped by T. Pittman and A. Kimball, June 1973

Figure 24 -- Point Astley prospect, sample locations and mineralized zones

Figure 24.--Point Astley prospect, sample locations and mineralized zones.



Base from map by D. P. Banister, 1962

Figure 25.-- Point Astley adits, sample locations

Figure 25.--Point Astley adits, sample locations.

Table 13.--Assay data, Pt. Astley prospect

Sample1/	Type	Length Ft.	Length (cm)	Semiquantitative Spectrographic Analysis ppm Ag	Mo	Atomic Absorption ppm Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
						Beach outcrop samples					
3K015	Channel	5.0	(152)	L	15	15	20	100	-	-	Phyllite with quartz stringers.
3K016	do.	5.0	(152)	N	N	15	20	65	-	-	Phyllite with euhedral crystals of pyrite.
3K017	do.	5.0	(152)	N	N	15	30	85	-	-	Quartz chlorite schist.
3K018	do.	5.0	(152)	L	N	5	15	100	-	-	do.
3K019	do.	5.0	(152)	N	5	10	20	140	-	-	do.
3K020	do.	5.0	(152)	N	10	25	50	200	-	-	do.
3K021	do.	4.0	(122)	.5	10	90	120	2600	-	-	do.
3K022	do.	6.0	(183)	.5	7	140	80	3000	-	-	Calcareous chlorite schist with sulfides.
3K023	do.	5.0	(152)	2	7	750	400	3600	-	-	Quartz calcareous schist with sulfides.
3K024	do.	5.0	(152)	N	N	40	20	2000	-	-	Schist with sparse sulfides.
3K025	do.	5.0	(152)	10	20	3700	2100	30000	N	2.7	Schist with sulfides, chiefly pyrite and sphalerite.
3K026	do.	5.0	(152)	5	5	5800	170	3000	-	-	Gray-green phyllite with sphalerite-rich bands parallel to foliation.
3K027	do.	5.0	(152)	2	5	660	80	3500	-	-	Schist with sulfide stringers parallel to foliation.
3K028	do.	5.0	(152)	2	5	600	85	1400	-	-	Light gray schist with some tion and thin quartz lenses.
3K028a	do.	4.6	(140)	N	N	25	20	120	-	-	Quartz and actinolite.
3K042	do.	5.0	(152)	.5	10	25	20	120	-	-	Phyllitic schist.
3K043	do.	5.0	(152)	.5	15	10	30	90	-	-	do.
3K044	do.	5.0	(152)	.5	7	270	25	120	-	-	Chlorite muscovite schist with quartz and disseminated sulfides.
3K045	do.	5.0	(152)	.5	7	70	150	1200	-	-	Chlorite muscovite schist with quartz.
3K046	do.	5.0	(152)	1	5	620	40	1500	-	-	do.
3K047	do.	5.0	(152)	1	5	570	30	1400	-	-	Dark green schist.
3K048	do.	5.0	(152)	2	5	670	55	1600	-	-	do.
3K049a	do.	7.0	(213)	.7	7	65	90	1500	-	-	Schist with thin stringers of pyrite with sphalerite.
3K049b	do.	5.0	(152)	1.5	10	95	500	2400	-	-	do.
3K050	do.	1.6	(49)	N	N	15	5	5	-	-	Quartz vein.
3K051	do.	1.6	(49)	N	N	15	5	5	-	-	do.
3K052	do.	.3	(9)	N	N	50	20	100	-	-	Chlorite schist.
3K053	do.	.5	(15)	N	N	100	20	80	-	-	
3K060	do.	2.5	(76)	.5	N	40	30	35	-	-	Quartz vein.
3K178	do.	1.1	(.34)	50	100	4400	3100	90000	L	159.1	Pod of massive pyrite with sphalerite, chalcopyrite and galena, parallel to schistosity.

1/ Atomic absorption gold below 0.05 ppm for all samples.

Table 13.--Assay data, Pt. Astley prospect, continued

Sample 1/	Type	Length Ft.	Length (cm)	Semiquantitative Spectrographic Analysis ppm Ag	Mo	Atomic Absorption ppm Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
						Adit #1 - Brown crosscut					
3K029	Channel	5.0	(152)	3	10	780	600	23000	-	-	Light gray silicified schist with thin quartz lenses and abundant sphalerite.
3K030	do.	5.0	(152)	5	10	950	350	13000	-	-	
3K031	do.	1.0	(30)	.5	N	10	15	100	-	-	Same as above, with sulfides.
3K032	do.	4.0	(122)	1	N	170	110	3400	-	-	Iron-stained schist with sulfides, chiefly pyrite and sphalerite.
3K033	do.	4.5	(137)	5	5	430	250	11000	N	N	do.
3K034	do.	6.0	(183)	20	30	1700	2200	40000	N	39.4	Schist with sulfides, mainly pyrite and sphalerite.
3K035	do.	5.0	(152)	1	5	250	50	8000	-	-	Iron-stained phyllitic schist with sulfides.
3K036	do.	3.5	(107)	L	10	35	20	190	-	-	do.
							Adit #2				
3K054	Channel	5.0	(152)	1	7	50	20	80	-	-	Phyllite with quartz lenses and iron sulfides.
3K055	do.	7.5	(229)	1	N	65	35	150	-	-	
3K056	do.	8.0	(244)	.7	N	55	85	1000	-	-	Gray-green schist with quartz rods or lenses.
3K057	do.	6.4	(195)	5	15	390	850	7500	-	-	Phyllite with thin quartz plates and disseminated sulfides.
3K058	do.	6.6	(201)	1	N	75	60	160	-	-	Gray schist, little quartz or sulfides.
3K059	do.	.8	(24)	100	30	4700	11000	45000	N	64.1	Schist with some quartz and sulfides.

1/ Atomic absorption gold below 0.05 ppm for all samples.

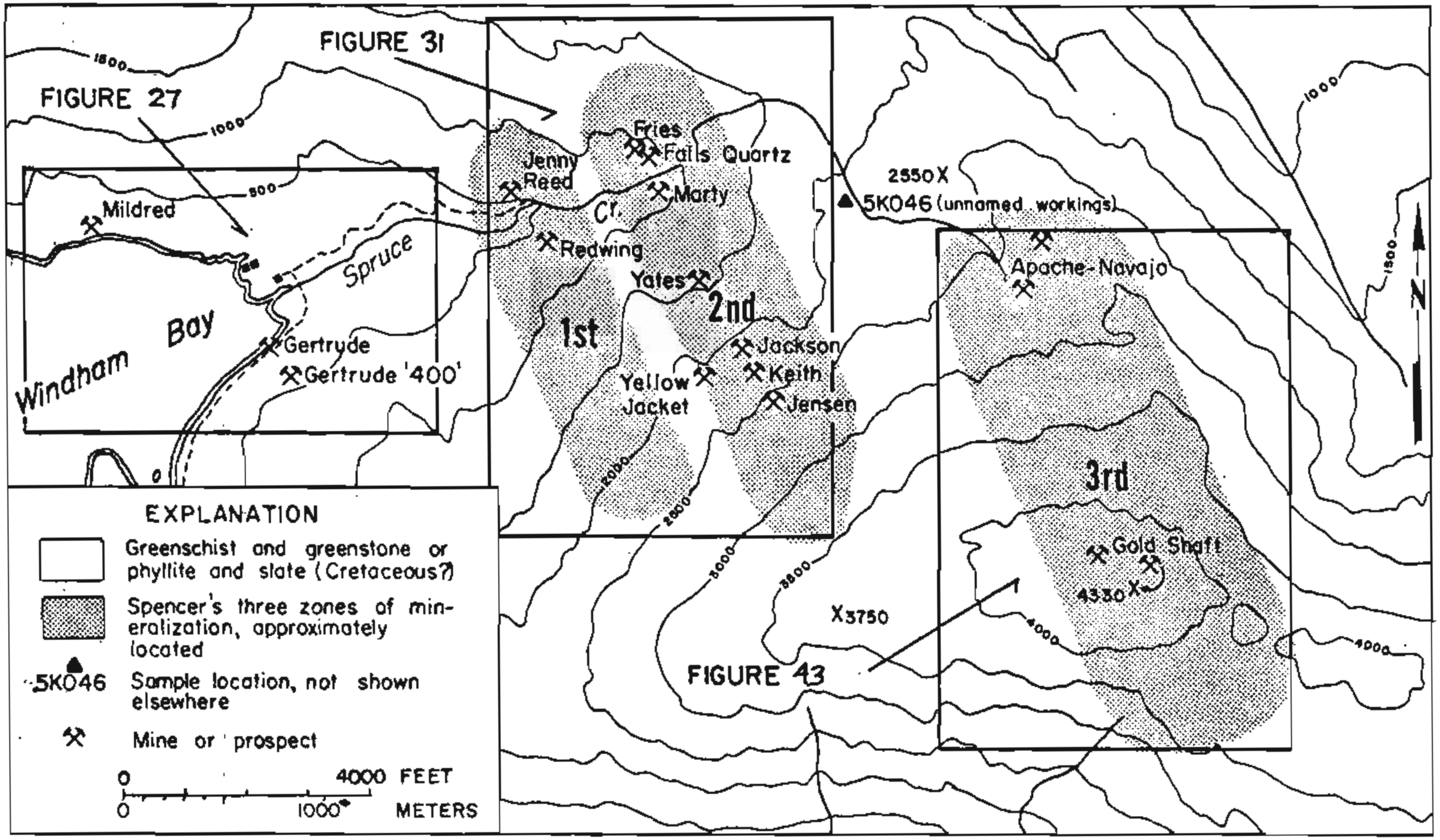
The southeast zone is exposed on the beach and in one of two short adits. The mineralization in Adit #1 is poorly exposed. On the surface the mineralized zone could not be traced. Adit #2, 200 feet to the south and approximately along strike, does not appear to intersect the sulfide-bearing zone. A shaft reported just northwest of the adits has been obliterated by a recent landslide. Samples in and near Adit #1 had weighted average values across a 30-foot section of 0.07 percent copper, 1.72 percent zinc, and 0.18 ounces silver per ton. Lead values were insignificant. One 6-foot section of this group, containing 4 percent zinc, had a copper content of 0.17 percent. Silver was reported as 0.59 ounces per ton.

Traces of silver were detected in sediments from the north-flowing stream whose mouth is immediately southeast of the Point Astley prospect. Fifteen samples were collected from sites along the 4,000-foot stretch of streambed between the tideline and the 950-foot elevation. Seven of the 15 samples contained 0.5 ppm silver each. Mineral grain studies made on concentrates of samples from two localities 400 and 600 feet upstream from the mouth showed traces of chalcopyrite. Atomic absorption analyses showed that neither sample contained significant copper or other base metals. All 15 samples were partially concentrated by panning before analysis.

Samples from the Point Astley prospect contained zinc, little copper and silver. Little or no gold is present. Due to the lack of continuity between the northwest and southeast zones of mineralization, a reserve estimate was not made.

South of this prospect bedrock is almost totally obscured by glacial deposits and heavy vegetation. The pan concentrate samples indicated that the mineralization extends into that drainage or that separate concentrations of minerals occur there.

In 1962 Bureau of Mines engineers (Banister, unpub. report) conducted a geophysical survey using self potential method along the shoreline in this area. The results of the survey gave no indication of massive sulfide mineralization.



Base from U.S. Geological Survey 1:63,360 Sumdum C-5 1951 and Sumdum C-4 1961

Figure 26.--Index map of Spruce Creek lodes

Figure 26.--Index map for Spruce Creek lodes.

Windham Bay area

Spruce Creek lodes and vicinity

This section of the report covers the area near the head of Windham Bay, the Spruce Creek drainage and the south side of Spruce Mountain. Rocks in the area consist of steeply dipping schists or phyllites striking at about N. 20° W. of the greenstone and greenschist map unit shown on plate 1. Several poorly defined parallel zones of alteration and sulfide mineralization hundreds of feet across follow northwest striking schistosity of the country rock. These zones contain quartz stringer zones that generally follow the schistosity of the country rock and individual larger quartz veins that follow and occasionally cut the structure of the country rock. Quartz veins more than one-quarter of a foot in width that cross the structure consistently have the highest gold values. These gold-bearing veins pinch out and cannot be traced for any great distance. Free gold is visible in some specimens. Some pyrite, pyrrhotite, galena, sphalerite and chalcopyrite are disseminated in the quartz veins. The higher gold values are often associated with galena. Spencer visited this area in 1904 and described three such zones at 1, 1.4 and 2.4 miles from the head of Windham Bay as the first, second and third zones (Spencer, 1906, p. 40). There is also a zone at the head of Windham Bay. Table 14 gives general information on prospects and individual

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TABLE 14 NEAR HERE.

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workings investigated and figure 26 is a general location map of the

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Figure 26 near here.

Spruce Creek area showing Spencer's zones of mineralization.

Table 14.-Spruce Creek prospects

Name of Property or Adit	Figure Number	Patented Lode Claims	Approximate Location	Type of Lode	Rock Type	Structure
			Prospects near the head of Windham Bay			
Mildred group	27,28	Ethel, May, Lucy, Verna, Mildred, Mildred Millsite	North shore Windham Bay and near head, 20-ft. elevation	50-ft. wide quartz stringer zone and 0.3-ft. thick quartz vein	Muscovite schist	Quartz veins N23W-@45SW; foliation N26W@78SW
Gertrude adit	27,29	-	Head of Windham Bay, 20-ft. elevation	Quartz pod	Phyllite	Massive quartz and irregular veins; foliation N10-23W@ 70-75SW
Gertrude "400" adit	27,30	-	Head of Windham Bay, 400-ft. elevation	Quartz pod	Phyllitic schist	Quartz pod; approximately N50W@35NE
Juneau and Boonville claims	-	Juneau and Boonville	Head of Windham Bay on Spruce Creek	Quartz stringers, quartz vein	Schist	Quartz stringers parallel to foliation of N10-14W@-74-80SW; vein N20W-@80NE
			Prospects on Spencer's first zone of mineralization			
Jenny Reed group	31,32	Venus Mine, Venus Mine No. 2, Polar Star, Polar Star Extension	North side Spruce Creek, elevation 550 feet	Quartz stringer zone	Muscovite schist	Quartz stringers parallel to foliation of N18W@80SW
Red Wing group	31,33	Crown, Blossom, Lenark, Red Wing, Broad, Cliff, Bird, Flossie	West side of Spruce Creek on Center Creek, 600-ft. elevation	1-ft. thick quartz vein	Muscovite schist	Quartz vein N55W-@44NE; foliation N20W@82SW
			Prospects on Spencer's second zone of mineralization			
Fries workings	31,34	Silent Partner #1	North side Spruce Creek, 900-ft. elevation	Quartz stringer zone in schist	Schist	Quartz stringers parallel to foliation of N15-30W@ 75-80SW
Falls Quartz adit	31,35	Falls Quartz	North side Spruce Creek, 950-ft. elevation	Quartz stringer zone and quartz veins	Schist	Quartz veins at N50W@65N; foliation N18W@65SW. Stringer zones follow foliation
Marty workings	31,36	-	South side Spruce Creek, 900-ft. elevation	Quartz stringer zone and quartz veins	Schist	Quartz veins at N45-50W@50NE
Unnamed adit near Marty	31,37	-	South side Spruce Creek, 1180-ft. elevation	Quartz stringer zone	Schist	Quartz veins at N35W@75S and N52E@63S; foliation N20W@75SW
Unnamed prospect pit near Marty	31,37	-	South side Spruce Creek, 1375-ft. elevation	Quartz stringer zone	Schist	Stringer zone that follows foliation of N15W@83SW
Yates adit	31,38	-	South side Spruce Creek,	Quartz veins	Brown schist	Quartz veins at N45W@75NE and N25W@72SW; foliation N25W@72SW

Table 14.--Spruce Creek prospects, continued

Workings Sampled During Study	Assay Values of Best Measured Samples	Year Activity Commenced (appr.)	Year of Last Reported Activity (appr.)	Source of Information	Remarks
			Prospects near the head of Windham Bay, continued		
545-ft. adit	5.0-ft. long chip with 0.10 ppm gold	1895	1905	Spencer, 1906, pp. 41-42	-
160-ft. adit	6.0-ft. long channel with 0.30 ppm gold	1920	1920	Buddington, 1923, p. 127 and the 1920 Annual Rept. of the Terr. Mine Inspector, p. 20	-
55-ft. adit	Random chip of quartz pod with 0.40 ppm gold	1920	1920	do.	
Water tunnel for a placer operation	No significant values found	1890	-	Spencer, 1906	-
			Prospects on Spencer's first zone of mineralization, continued		
Two adits, 180-ft. and 20-ft. long	3.9-ft. long channel with 1 ppm gold	1900	1904	Spencer, 1906, p. 41	There is probably a short adit that was not found
20-ft. crosscut, 100-ft. of 10-ft. high drift stope	1.0-ft. channel with 30 ppm silver and 0.70 ppm gold	1898	1903	Spencer, 1906, pp. 40-41	The main workings rep reported to be a 600-ft. long drift stope were not entered because of caved portals
			Prospects on Spencer's second zone of mineralization, continued		
300-ft. long crosscut and 30-ft. raise	10.0-ft. chip sample with 0.10 ppm gold	1895	1930	Spencer, 1906, p. 41; Palmer, 1937, p. 9	The whole length of the crosscut was sampled with no significant assay returns
36-ft. long adit	3.9-ft. channel with 0.10 ppm gold	1915	1915	Juneau claim records	-
540-ft. long adit with 490 ft. crosscut and 3 raises	10.0-ft. channel with 0.4 ppm gold	1904	1936	Spencer, 1906; Palmer, 1937	This adit was extensively sampled across structure with no significant assay returns
20-ft. long adit	6.6-ft. channel with 0.05 ppm silver	-	-	-	-
Pit, 13-ft. square and 2-ft. deep	3.5-ft. channel with 0.05 ppm gold	-	-	-	-
40-ft. long crosscut, 35-ft. drift	90-ft. long channel with 0.05 ppm gold	1917	1937	Buddington, 1923, p. 26; Palmer, L. A., 1937	-

Table 14.--Spruce Creek prospects, continued

Name of Property or Adit	Figure Number	Patented Lode Claims	Approximate Location	Type of Lode	Rock Type	Structure
Prospects on Spencer's second zone of mineralization, continued						
Jackson adit (View Fair claim)	31,39	-	South side Spruce Creek, 2160-ft. elevation	Quartz vein	Schist	Quartz vein at N30W@65SE; foliation N10-20W@E-65-75E
Keith adit (View Fair claim)	31,40	-	South side Spruce Creek, 2160-ft. elevation	Quartz veins, quartz stringer zone	Schist	Quartz veins, N30W-@80NE; foliation N20W@70SW
Yellow Jacket workings	31,41	-	South side Spruce Creek,	Quartz pod	Phyllite schist	Quartz pods and stringers, irregular but approximately parallel to foliation of N15W@-70SW, N55W@55NE
Jensen mine (View Fair claim)	31,42	-	South side Spruce Creek, 2550-ft. elevation	Quartz pod	Schist	Quartz veins: main vein N55W@60NE, others N45-60W@-45-70E; foliation N50W@±70NE
Prospects on Spencer's third zone of mineralization						
Unnamed workings (sample 5K046)	-	-	400 ft. west of Spruce Creek, 2050-ft. elevation	Iron-stained irregular quartz veins	Schist	Foliation N20E@-70SW; quartz vein N30W@vertical
Apache-Navajo prospect	43,44,45	Apache-Navajo	Near Spruce Creek, elevation 2370 ft.	Quartz veins	Brown schist	Quartz veins (very irregular) N35-45W-@55-70W, N04-08W-@±70SW
Gold Shaft claims	43,46	-	Summit of Spruce Mountain between 4250 and 4330 ft.	Quartz veins, quartz stringer zones	Schist	-

Table 14.--Spruce Creek prospects, continued

Workings Sampled During Study	Assay Values of Best Measured Samples	Year Activity Commenced (appr.)	Year of Last Reported Activity (appr.)	Source of Information	Remarks
Prospects on Spencer's second zone of mineralization, continued					
58-ft. long adit	0.3-ft. channel with 2.5 ppm gold	1915	1938	Thane, B. L., 1915, p. 3	-
125- 125-ft. long adit	10.0-ft. channel with 2.4 ppm gold	1915	1938	do.	-
25 ft. adit, 10-ft. adit, 15-ft. x 15-ft. open cut	11.0-ft. channel with 0.3 ppm gold	1900	1900	Spencer, 1906,	-
50-ft. cross-cut and 275-ft. drift, plus stope	0.65-ft. channel with 17.08 oz. gold/ton	1927	1927	Buddington, A. F., 1923, p. 126; Willis, C. S., 1926-27, Supplement.	-
Prospects on Spencer's third zone of mineralization, continued					
8-ft. long adit	1.0-ft. channel with 0.7 ppm silver (SK046)	-	-	-	-
60- & 80-ft. long adits & a shallow trench	Traces(L) of gold and up to 0.07 ppm silver	1900	1903	Spencer, 1906, p. 41	Claims patented in 1909
14-ft. deep shaft, 156-ft. long x 3-ft. wide trench and 4 small open pits	3.8-ft. channel with 8 ppm gold	1915	1940	Originally located as the Free Gold group of claims	-

A foot trail follows a badly deteriorated corduroy (log-surfaced) road from the head of Windham Bay along the north side of Spruce Creek to the Marty mill.

Nineteen open adits which varied in length from 8 feet to 1,000 feet were located, mapped and sampled. These adits were generally driven on quartz stringer zones and on large quartz veins that were both parallel to and crosscut the structure. Samples were also taken of surface exposures of quartz veins or altered zones.

With the exception of the Jensen mine and the prospects and iron-stained zones near the summit of Spruce Mountain, the workings investigated generally contained only traces of gold. The values in base and precious metals from the iron-stained zones between the Apache-Navajo prospect and the summit of Spruce Mountain from the altered zone on and the south side of Spruce Mountain indicate that the area may warrant further exploratory investigation. The best gold values for a section of significant length and width were found in the Jensen main vein. Parts of the quartz vein sampled underground at the Jensen mine assayed 0.05 ounces gold per ton for a 68-foot-long section of vein over a 4-foot stoping width. The sample results contributing to this average grade were erratic. This grade of gold ore cannot be mined under present conditions considering the small tonnage and remote location. One sample of the surface exposure of the Jensen underground vein system assayed at 2.77 ounces gold per ton over a 4-foot stoping width and another assayed nil. A recorded gold production from the Jensen mine in 1927 was $1,100. Old records report a somewhat smaller additional amount from the area.

In general, the gold mineralization in the Spruce Creek area is spotty and the gold-bearing veins generally are not very long. Any ore shoots found will probably be of limited extent. Prospecting for pockets of gold is difficult. If the price of gold increases significantly, this area may warrant further prospecting. These deposits as now known are not recoverable under present economic conditions.

Mineralized area near the head of Windham Bay

Eight patented lode claims and the Mildred, Gertrude and Gertrude "400" adits are located within this area (fig. 27). The Mildred adit

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Figure 27 near here.

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was driven around the turn of the century and the Gertrude and Gertrude "400" adits were driven about 1920. Maps of the prospects are shown in figures 28 through 30 and table 15 gives the assay returns. These adits

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Figures 28 through 30 near here.

TABLE 15 NEAR HERE.

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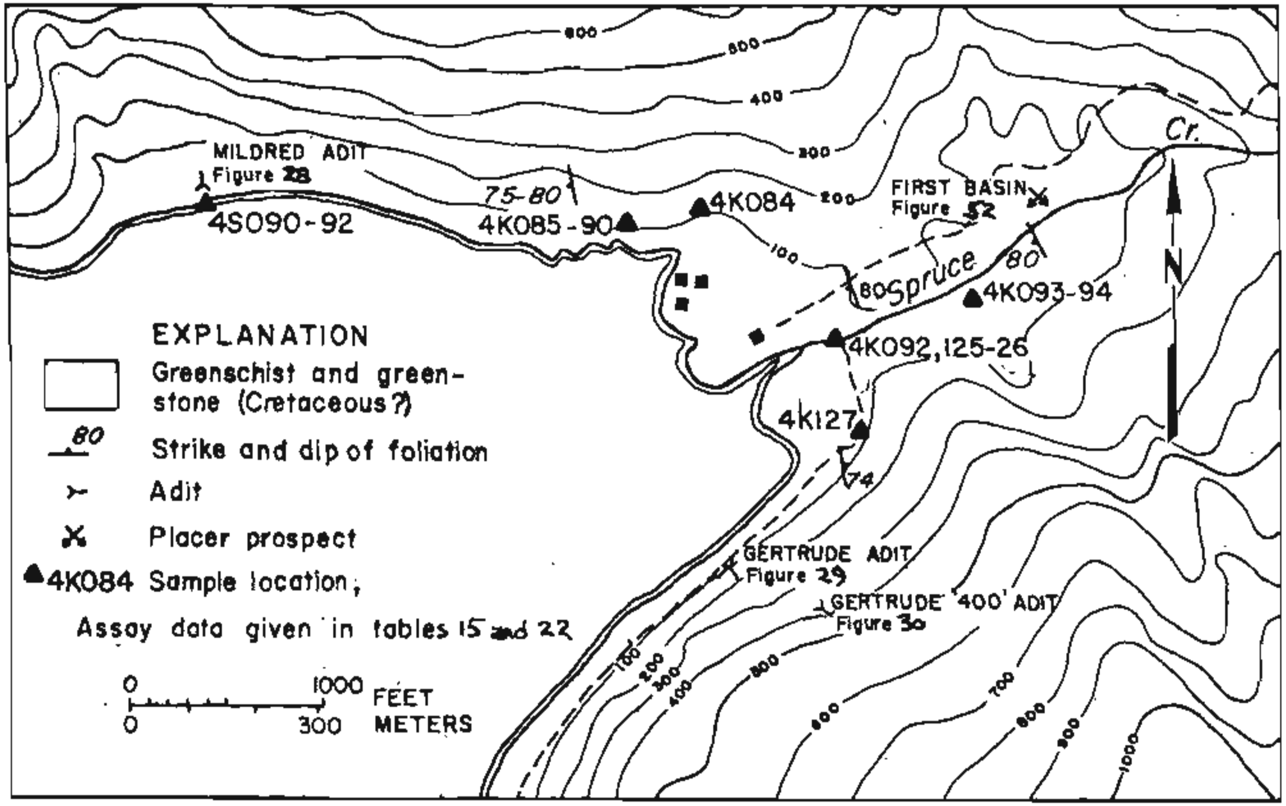
were driven on quartz veins or stringer zones in schist country rock. The best assay results from measured samples taken in the area were in the Gertrude adit. The best sample, a 6-foot-long channel, assayed at 3 ppm silver, 0.30 ppm gold, and 210 ppm lead. Traces of gold were found in each adit but, in general, the sample results were not encouraging.

Table 15.--Assay data, Mineralized area near the head of Windham Bay

Sample 1/	Type	Length Ft.	Length (m)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption Au	Atomic Absorption Cu	Atomic Absorption Pb	Atomic Absorption Zn	Description
						Mildred adit			
4S084	Channel	4.7	(1.4)	N	N	55	15	45	Muscovite schist with quartz stringer zones.
4S085	do.	6.0	(1.8)	N	N	25	20	40	do.
4S088 2/	Chip	5.0	(1.5)	N	0.1	10	20	65	do.
4K091 3/	Selected grab	-	-	300	9.0	100	15000	140	Massive pyrite.
						Gertrude adit			
4K074	Channel	11.0	(3.4)	N	N	20	10	40	Muscovite schist with quartz stringers parallel to foliation.
4K075	do.	10.0	(3.0)	N	N	25	25	65	do.
4K076 4/	do.	6.0	(1.8)	3	0.30	65	210	25	do.
4K077	Selected grab	-	-	150	7.0	180	2800	25	Quartz and pyrite.
4K078	Channel	3.8	(1.2)	1	.10	60	100	200	Muscovite schist.
						Gertrude 400 adit			
4K080	Channel	0.5	(0.2)	N	N	5	10	20	Iron-stained quartz vein.
4K081	Random chip	-	-	.5	0.40	5	20	10	Composite of approximately 40 pieces broken from quartz vein and pods.
4K082	Channel	.6	(.2)	N	N	10	10	20	Iron-stained quartz vein.
						Other samples			
4K092	Spaced chip, 0.5-ft. interval	28	(8.5)	L	N	35	25	55	Iron-stained green schist with quartz seams parallel to foliation, no visible sulfides.
4K093	Selected grab	-	-	L	N	15	20	5	Quartz vein.
4K094	Composite chip	40	(12.2)	0.5	N	10	10	80	Dark gray schist.
4K125	Spaced chip, 1-ft. interval	34	(10.4)	L	N	25	10	50	Light brown iron-stained schist, considerable fine sulfides.
4K126	Chip	2.0	(.6)	N	N	5	L	5	Iron-stained quartz vein or pod with pyrite.
4K127	do.	21.0	(6.4)	N	N	15	5	35	Iron-stained schist with quartz stringers parallel to foliation.

1/ Sample 4K084-090 where taken in the area and did not contain any significant metal values.
2/ Fire assay analysis gave N for Au and 0.7 ppm Ag.
3/ Semiquantitative spectrographic analysis gave G10000 As.
4/ Fire assay analysis gave 1.4 ppm and 6.5 ppm, respectively, Au and Ag.



Base from U.S. Geological Survey 1:63,360 Sumdum C-5 1951 and Sumdum C-4 1961

Figure 27.--Mineralized area near the head of Windham Bay, prospect and sample locations

Figure 27.--Mineralized area near the head of Windham Bay, prospect and sample locations.

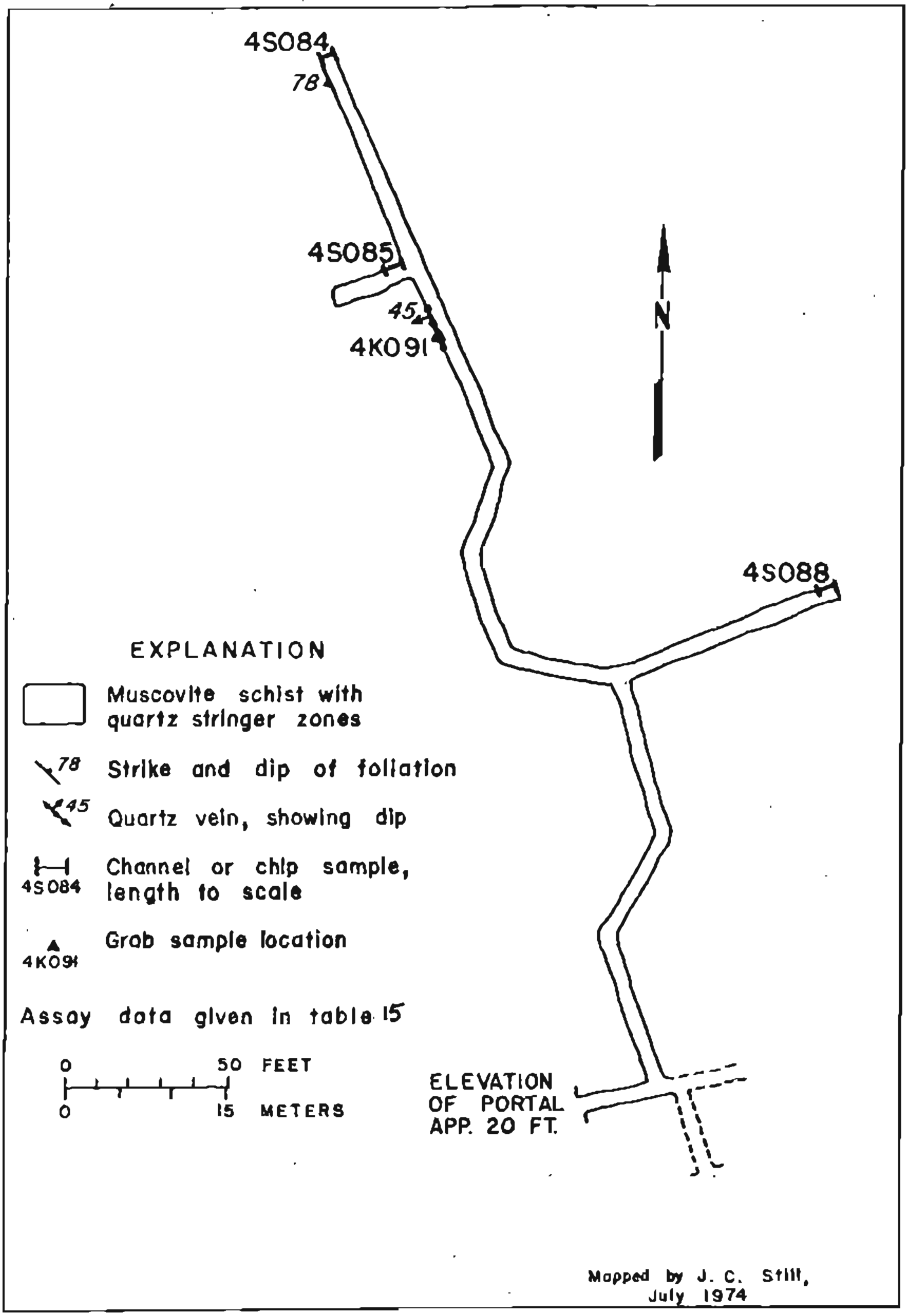
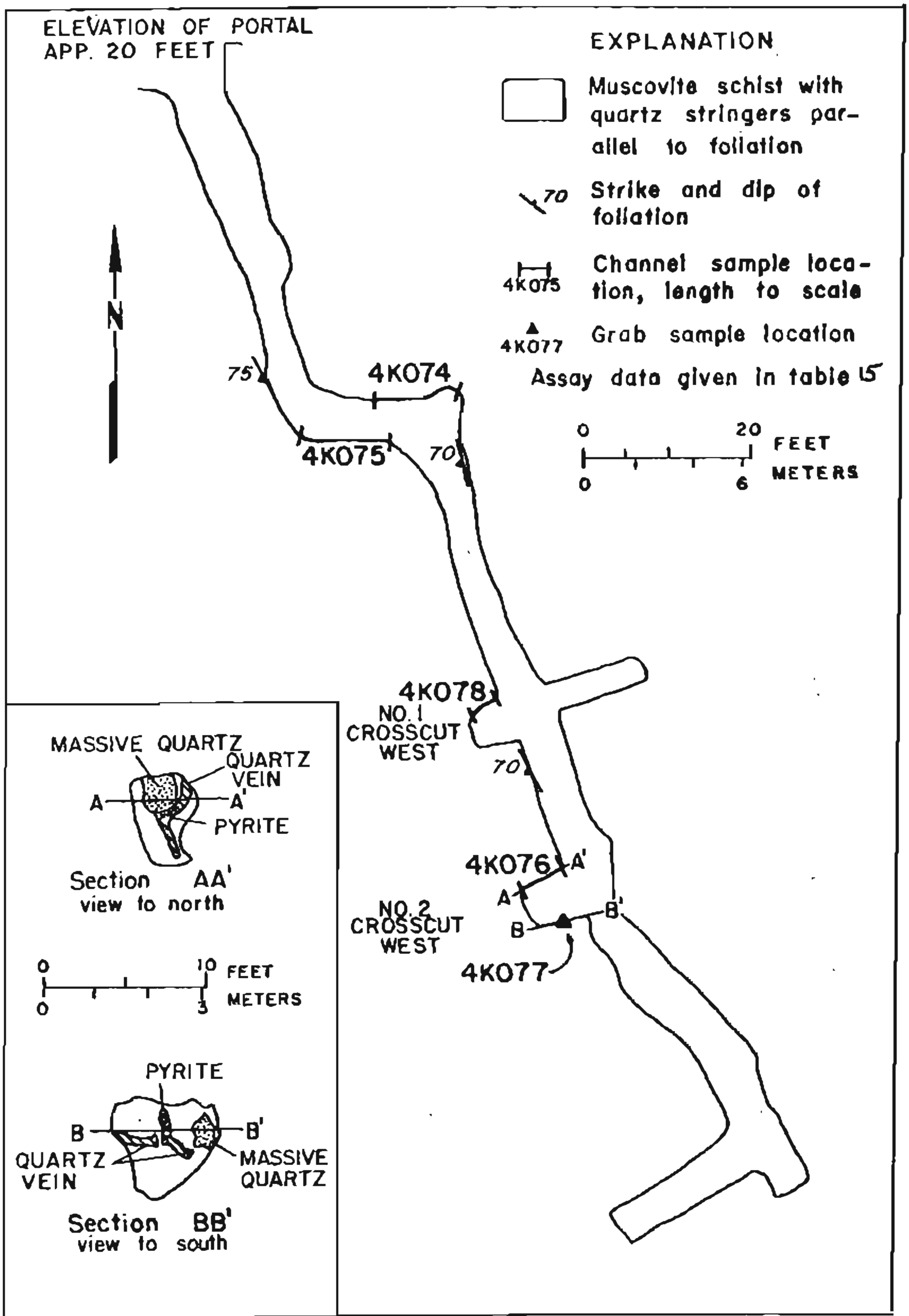


Figure 28.-- Mildred adit, sample locations

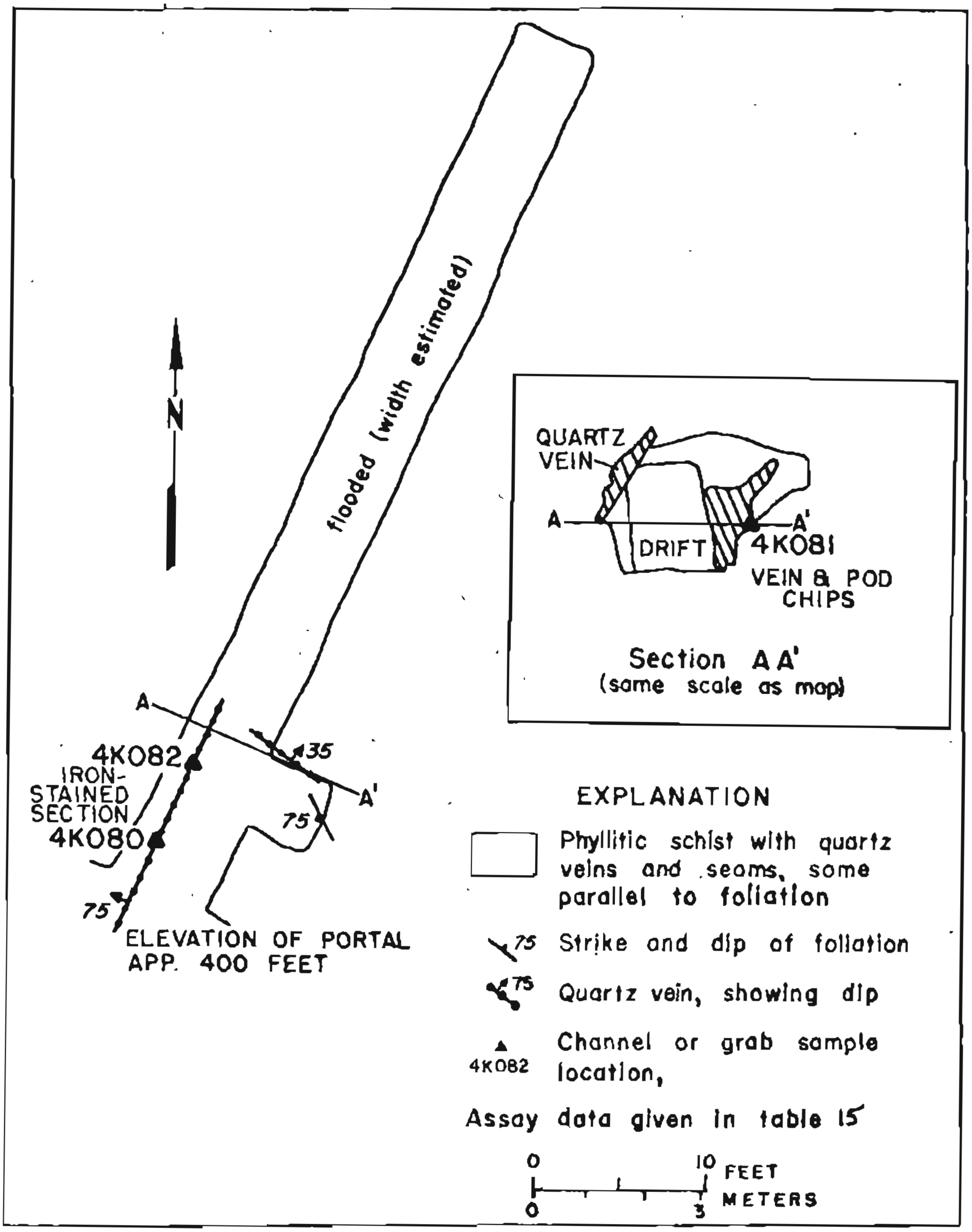
Figure 28.—Mildred adit, sample locations.



Mapped by A. Kimball and M. A. Parke, July 1974

Figure 29 -- Gertrude adit, sample locations

Figure 29.—Gertrude adit, sample locations.



Mapped by A. Kimball and M. A. Parke, July 1974

Figure 30.--Gertrude "400" adit, sample locations

Figure 30.--Gertrude "400" adit, sample locations.

Spencer's first zone of mineralization

A group of 12 patented claims are located along Spencer's first zone of mineralization (fig. 31) along Kabler Creek on the north side of Spruce Creek, and along Center Creek on the south side of Spruce Creek.

The Jenny Reed property is located along Kabler Creek and consists of two adits driven on a zone of quartz stringers that contains finely disseminated pyrite, sphalerite and chalcopyrite. The zone and stringers are parallel to the foliation of the schist and phyllite. Figure 32 is a map of the workings and table 16 gives the assay returns. The most

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Figures 31 and 32 near here.

TABLE 16 near here.

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significant sample in both adits was in adit #1. A 7.4-foot-long channel sample, 4S112, assayed 1.0 ppm gold.

The Red Wing property is located along Center Creek and consists of an adit caved at the portal, the remains of a millsite, and an adit stoped out to a maximum height of 10 feet. Figure 33 is a map of the

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Figure 33 near here.

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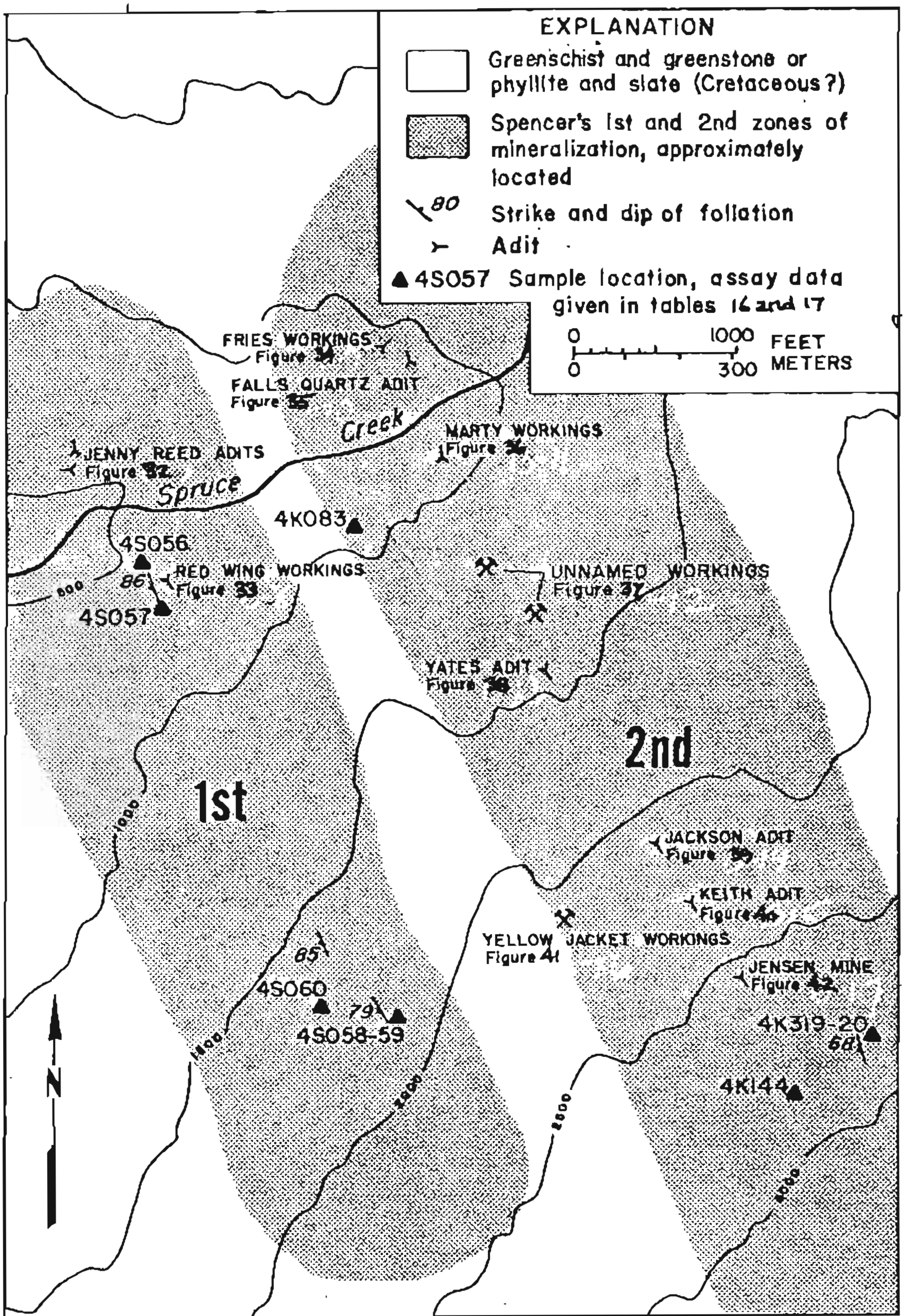
workings and table 16 gives the assay results. The adit stope was driven on a 1-foot-thick quartz vein which contained occasional pyrite, pyrrhotite, sphalerite, galena and chalcopyrite that crossed the foliation of the schist country rock. Sample 4S069, a 1-foot channel across the quartz vein, assayed 30 ppm silver and 0.70 ppm gold. This was the highest value sample taken on the Red Wing property.

Table 16.--Assay data, Spencer's first zone of mineralization.

Sample	Type	Length Ft.	(cm.)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption ppm Au	Pb	Zn	Fire Assay ppm Au	Ag	Description
				Redwing mine workings						
4S068	Chip	2.0	(61)	N	0.05	25	140	-	-	Muscovite schist, hanging wall of quartz vein.
4S069	Channel	1.0	(30)	30	.70	80	45	N	5.8	Quartz vein.
4S070	Chip	4.7	(143)	.5	.10	20	75	-	-	Muscovite schist, footwall of quartz vein.
4S071	do.	5.0	(152)	1.5	L	20	85	-	-	Muscovite schist.
4S072	Channel	1.1	(34)	N	N	5	10	N	3.1	Quartz vein.
4S073	Chip	5.0	(152)	N	N	15	90	-	-	
4S074	Channel	.5	(15)	N	N	5	280	-	-	Quartz vein.
4S075	do.	1.5	(46)	N	N	5	20	-	-	do.
4S079	do.	.35	(11)	N	N	15	90	-	-	do.
4S080	do.	.25	(8)	2	N	25	50	-	-	do.
				Jenny Reed adits - adit #1						
4S105	Channel	2.3	(70)	N	N	15	110	-	-	Quartz stringer zone in muscovite schist.
4S106	do.	.8	(24)	N	N	55	160	-	-	Quartz eye.
4S107	do.	1.7	(52)	N	N	25	130	-	-	Muscovite schist.
4S109	Chip	10.0	(305)	N	N	10	200	-	-	Quartz stringer zone in muscovite schist.
4S110	do.	12.0	(366)	0.7	L	30	650	-	-	do.
4S112	Channel	3.9	(119)	N	0.05	20	480	1.0	L	Muscovite schist with quartz stringers and lenses taken across back of adit.
4S113	do.	2.5	(76)	N	L	15	450	-	-	Quartz vein.
4S114 1/	Chip	7.4	(226)	.7	L	65	2400	-	-	Quartz stringer zone in muscovite schist.
				Jenny Reed adits - adit #2						
4S129	Chip	10.0	(305)	0.5	N	15	490	-	-	Muscovite schist with finely disseminated sulfides.
4S130	do.	11.6	(354)	1	L	10	1900	-	-	do.
				Other samples Spencer's first zone of mineralization						
4S056	Channel	0.2	(6)	N	N	70	90	-	-	Quartz vein.
4S057	Channel	5.7	(174)	0.7	N	15	70	-	-	Quartz stringer zone in schist.
4S058	Channel	0.3	(9)	N	0.05	10	40	-	-	Quartz vein containing sulfides.
4S059	Composite	5	(152)	0.5	0.10	20	140	-	-	Quartz stringer zone in schist.
4S060	Channel	5.0	(152)	N	N	10	50	-	-	Quartz stringer in schist.

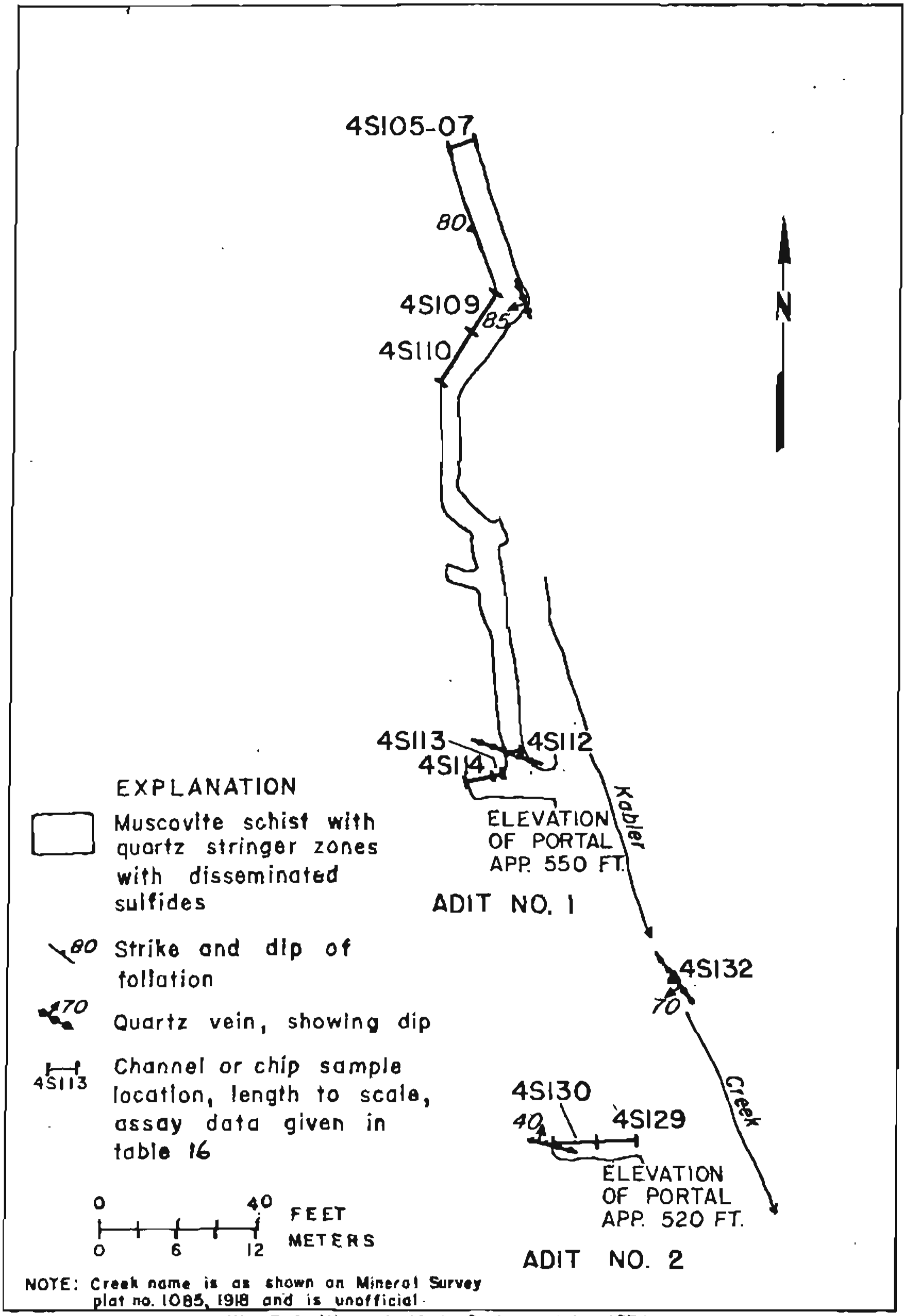
1/ Semiquantitative spectrographic analysis gave 250 ppm Cu.



Base from U.S. Geological Survey 1:63,360 Sumdum C-4 1961

Figure 31.-Spencer's first and second zones of mineralization, prospect and sample locations

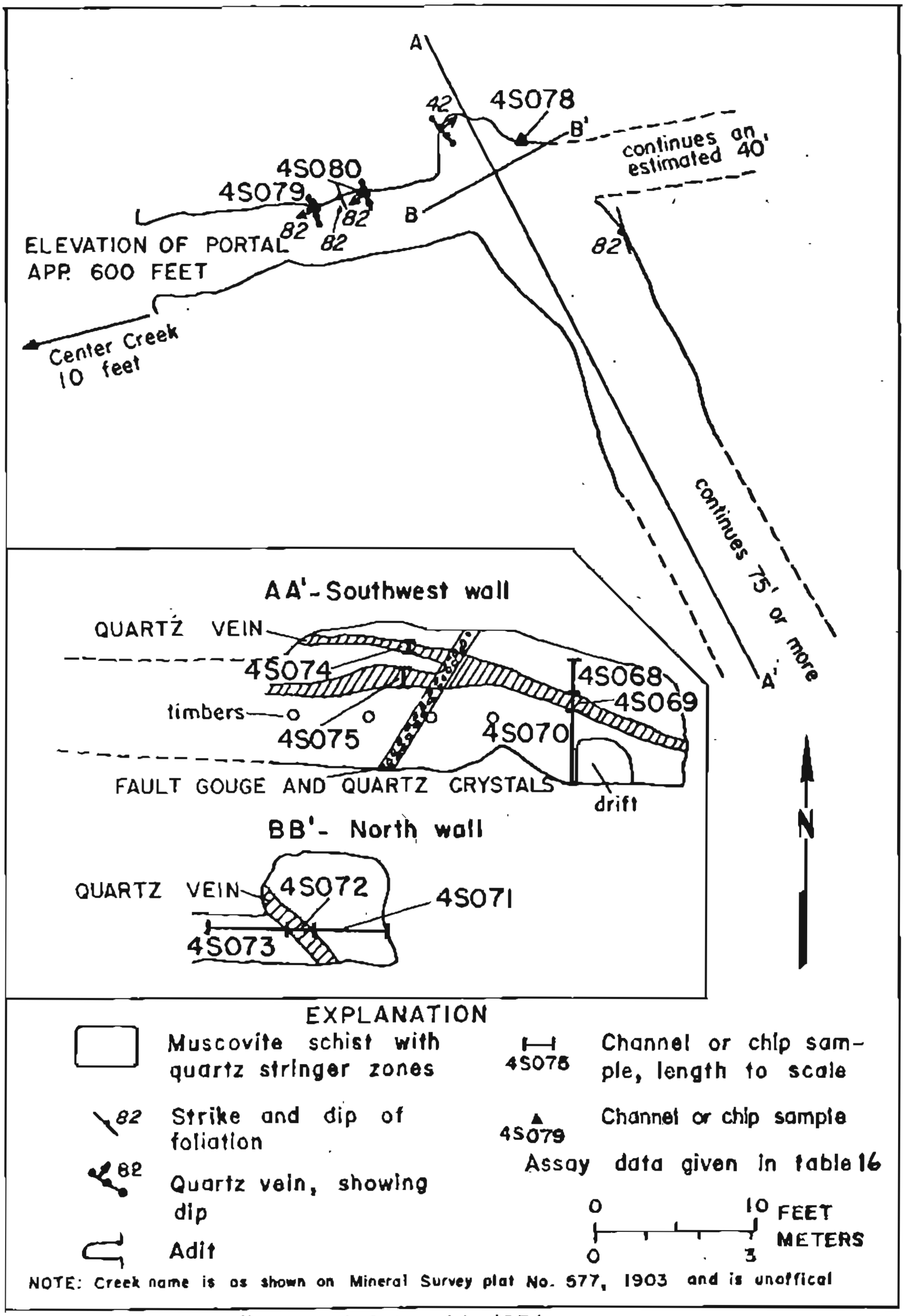
Figure 31.--Spencer's first and second zones of mineralization, prospect and sample locations.



Mapped by J. C. Still, F. Smith and M. A. Parke, July 1974

Figure 32.-- Jenny Reed adit, sample locations

Figure 32.--Jenny Reed adits, sample locations.



Mapped by J. C. Still and F. Smith, July 1974

Figure 33.-- Red Wing Mine workings, sample locations

Figure 33.—Red Wing mine workings, sample locations.

Spencer's second zone of mineralization

A group of claims known as the Marty group is located on the mineralized zone about 1-1/4 miles east of the head of Windham Bay. In the early 1920's, this group of claims was formed by consolidating 35-1/4 claims previously known as the Alaska Peerless, California-Alaska, and the Yellow Jacket Mining Company (Willis, 1926, p. 3; Williams, 1938, p. 1-4; Spencer, 1906, p. 40-41). In about 1930, this group of claims was taken over by the Alaska Windham Gold Mining Company. Three of the claims are patented: the Silent Partner #1 and #2 (Fries adit) and the Falls Quartz (Falls Quartz adit). This claim group is located along Spencer's second zone of mineralization primarily but extends to the third zone. The portion of the claims located along Spencer's second zone of mineralization up to an elevation of 2,700 feet on the south side of Spruce Creek have become known as the Marty group.

These claims occur in muscovite schist that strikes about N. 30° W. with gold values mostly in quartz veins. The highest gold values are consistently in the larger quartz veins that crosscut the structure of the country rock.

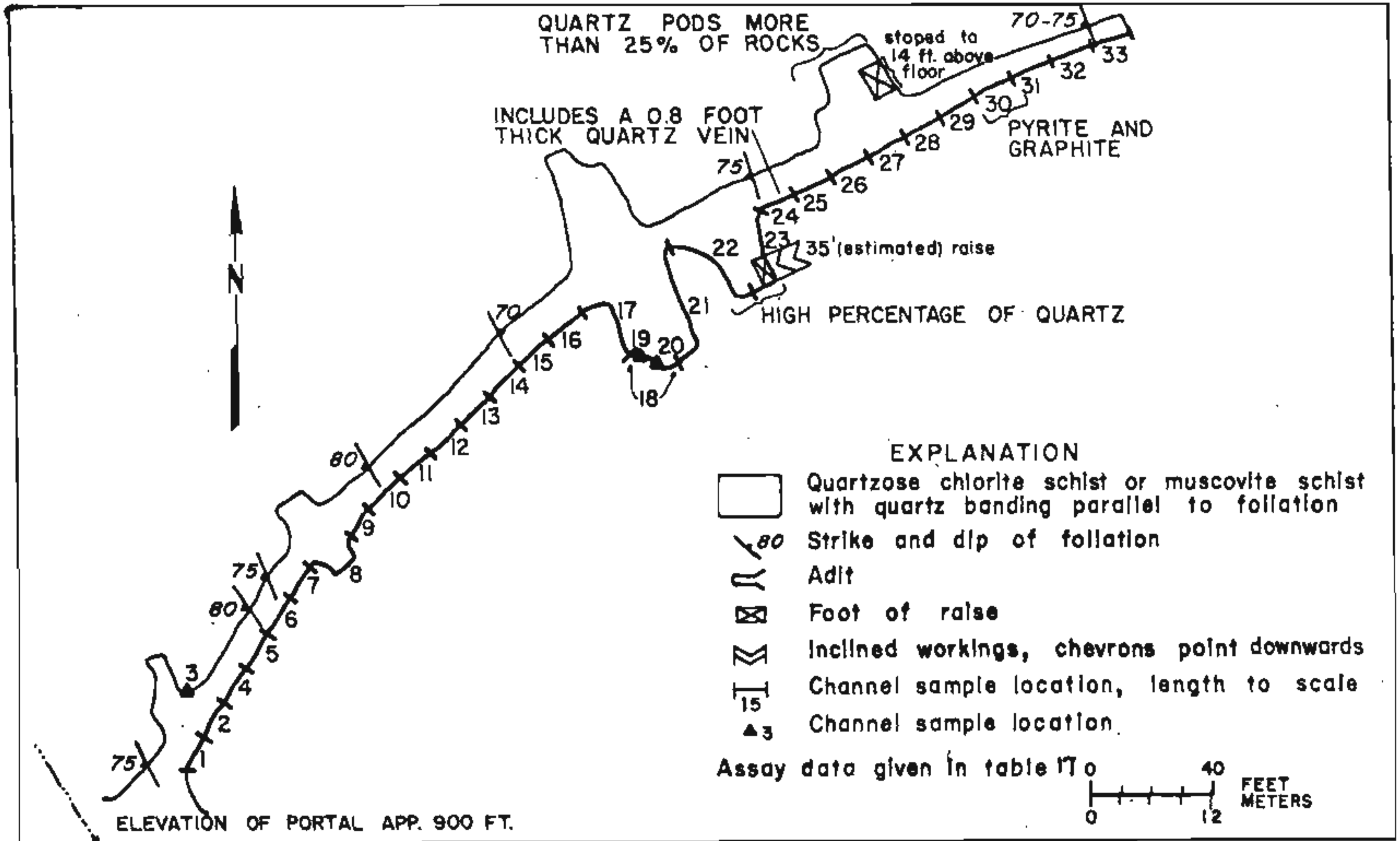
This area has ten adits totaling 2,000 feet in length. Table 14 gives a brief history of each adit. In about 1900, a 3,000-foot cable tram was erected between the Yellow Jacket prospect and a stamp mill on the south side of Spruce Creek (Spencer, 1906, p. 41), and in 1927 another cable tram 4,400 feet long was erected between the Jensen adit and a lane mill completed in 1926 on the north side of Spruce Creek (Willis, p. 4). In the early 1930's, a corduroy road was constructed from Windham Bay to the Marty mill. By 1974, both cable trams were down, the mill was in ruin, and the mine buildings had collapsed. All ten adits were still open and were generally safe to work in with the exception of the areas with loose rock supported by old lagging or timbers. It is doubtful that any assessment work has been done on these claims for some time although the ground was restaked briefly in 1973, investigated, and dropped in the same year.

The Fries and Marty adits were sampled in increments for 280 feet and 320 feet, respectively, across structure with no significant assay returns. The remaining smaller adits were also sampled with no significant results. Maps of each of these adits with sample locations are given in figures 34 through 42. Table 17 gives the assay returns.

Figures 34-42 near here.

TABLE 17 NEAR HERE.

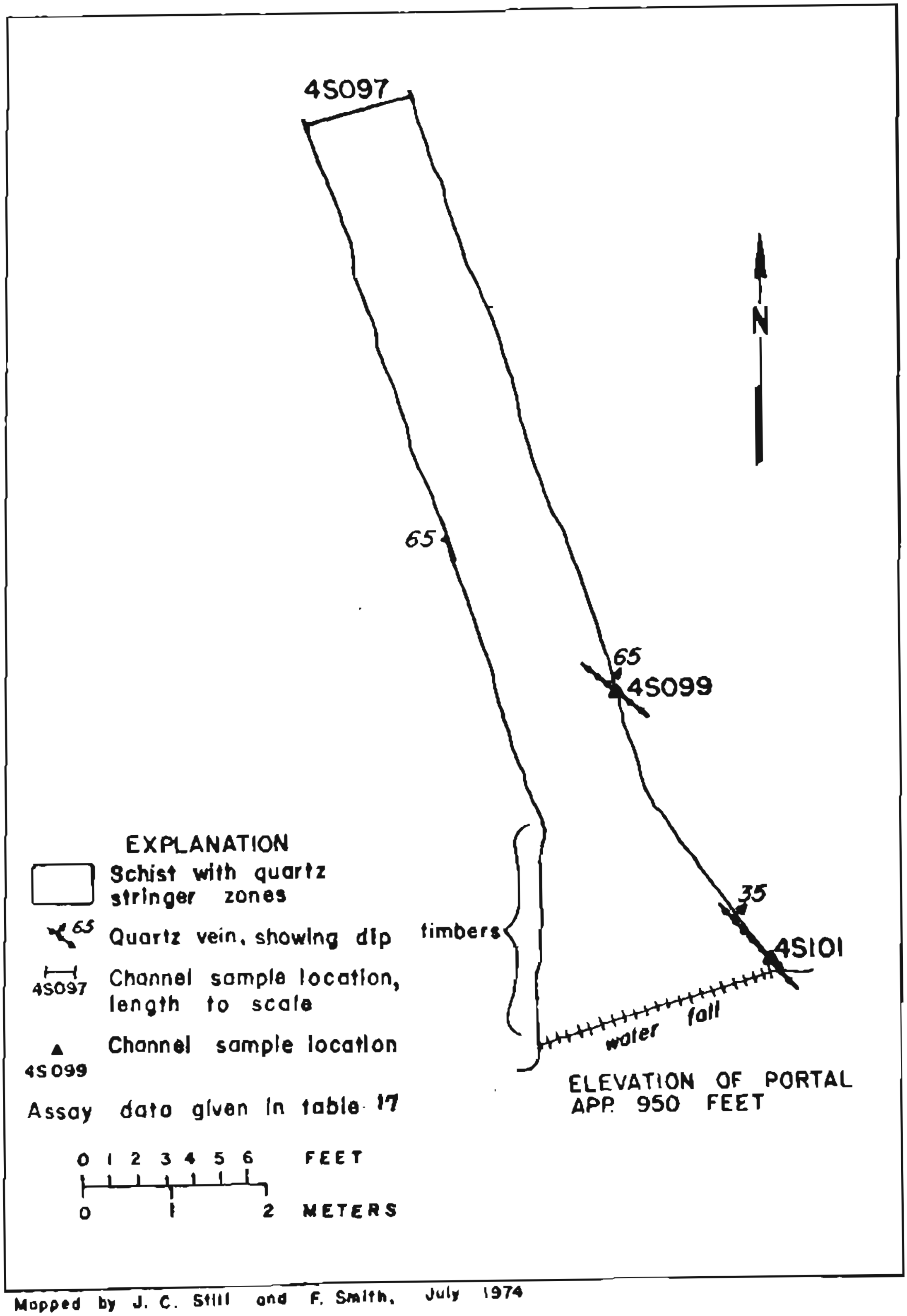
In Spencer's second zone of mineralization, the only significant gold values were found in the Jensen mine.



Mapped by A. Kimball and M. A. Parke, July 1974

Figure 34. -- Fries workings, sample locations

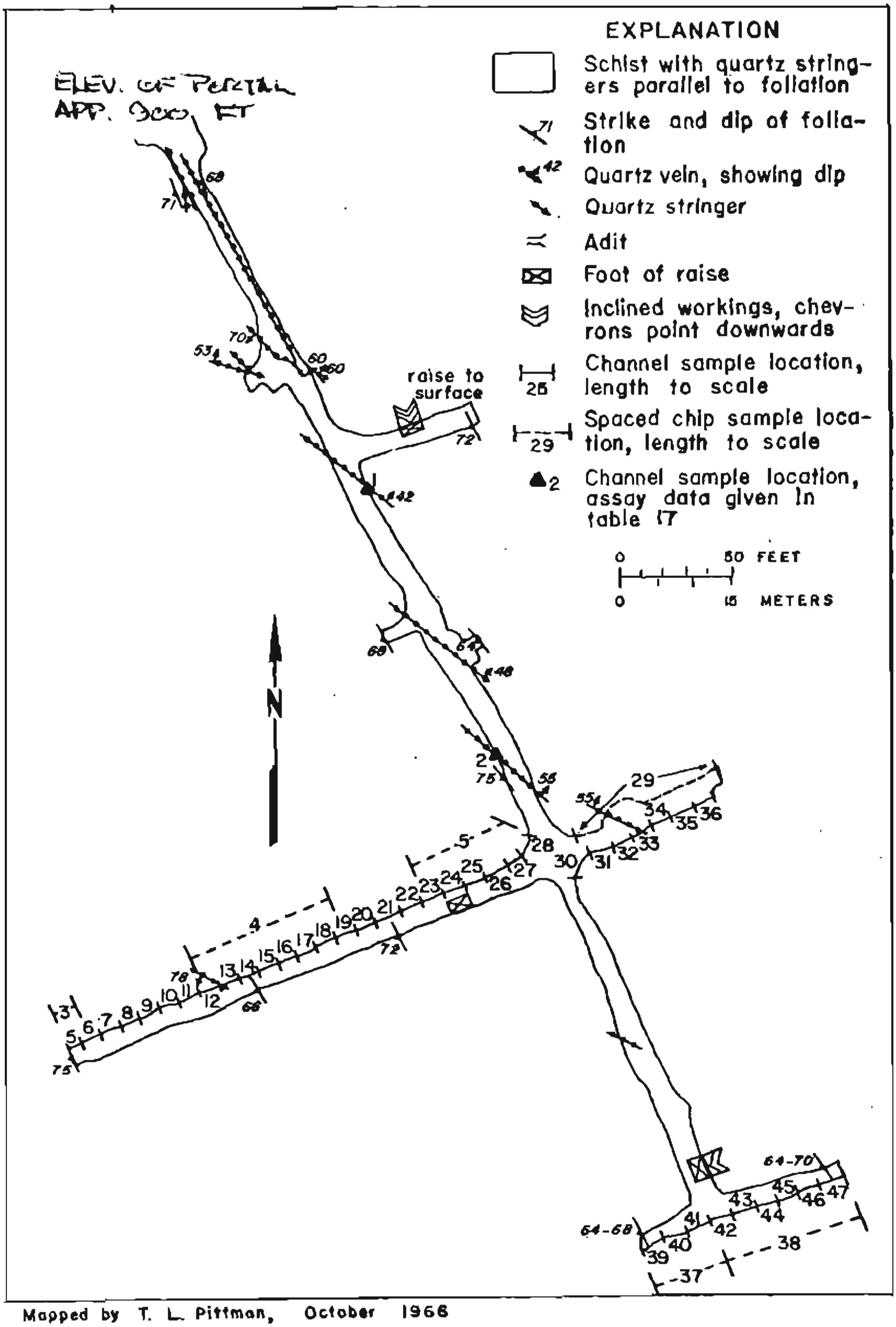
Figure 34.--Fries workings, sample locations.



Mapped by J. C. Still and F. Smith, July 1974

Figure 35.-- Falls Quartz adit, sample locations

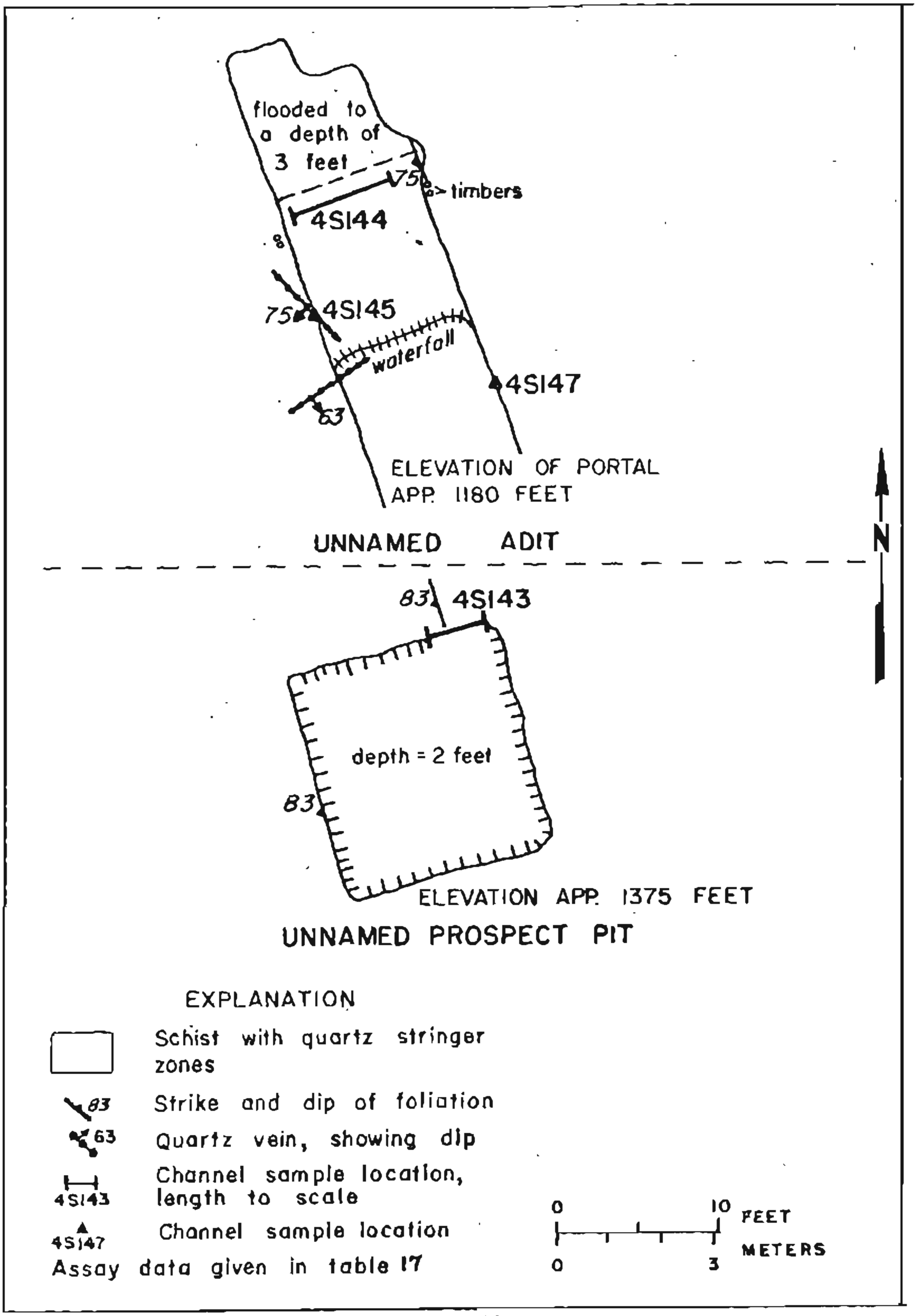
Figure 35.--Falls Quartz adit, sample locations.



Mapped by T. L. Pittman, October 1966

Figure 36.-- Marty Mine, sample locations

Figure 36.--Marty workings, sample locations.



Mapped by J. C. Still and F. Smith, July 1975

Figure 37. -- Unnamed workings near Marty, sample locations

Figure 37.--Unnamed workings near Marty, sample locations.

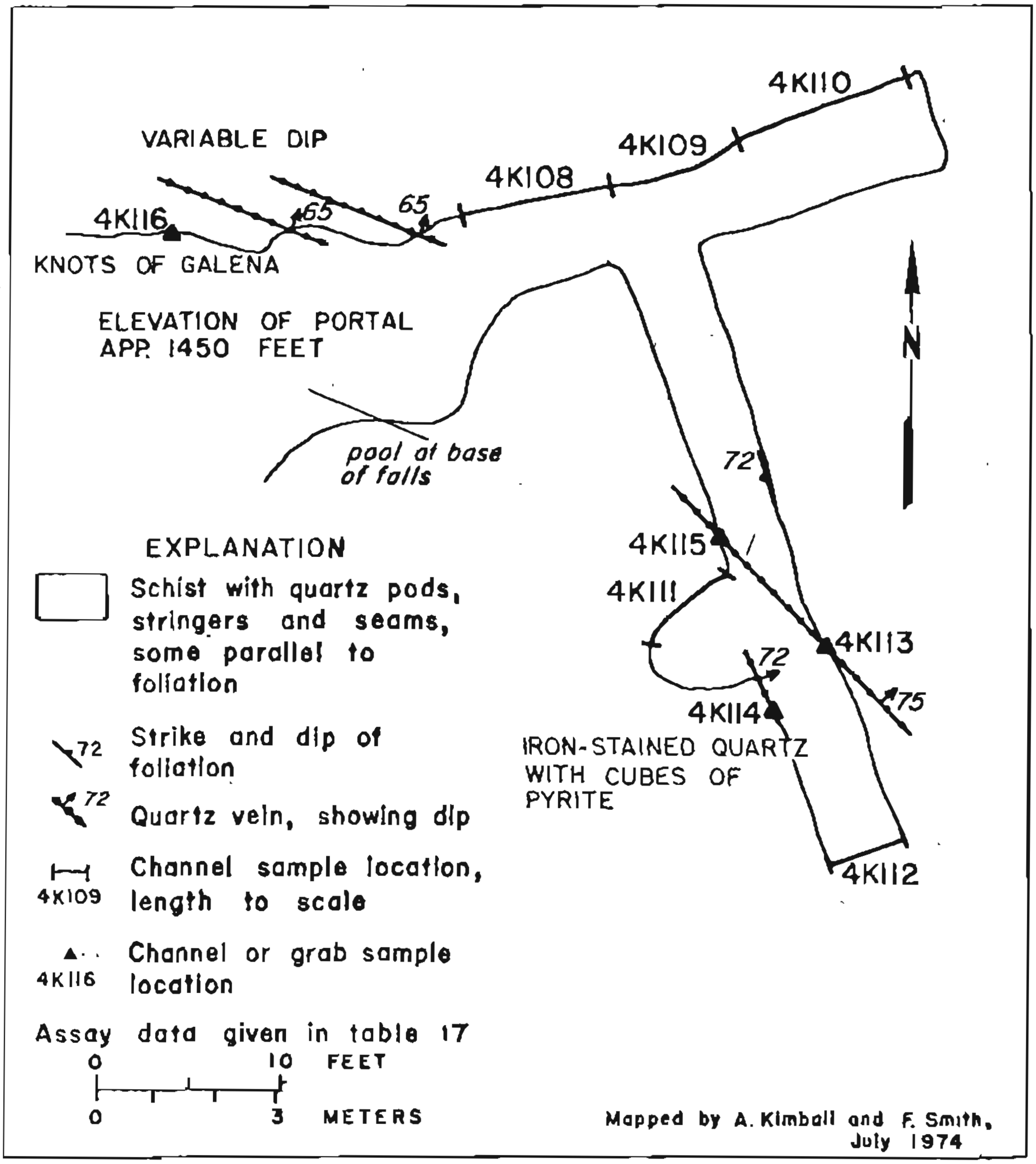
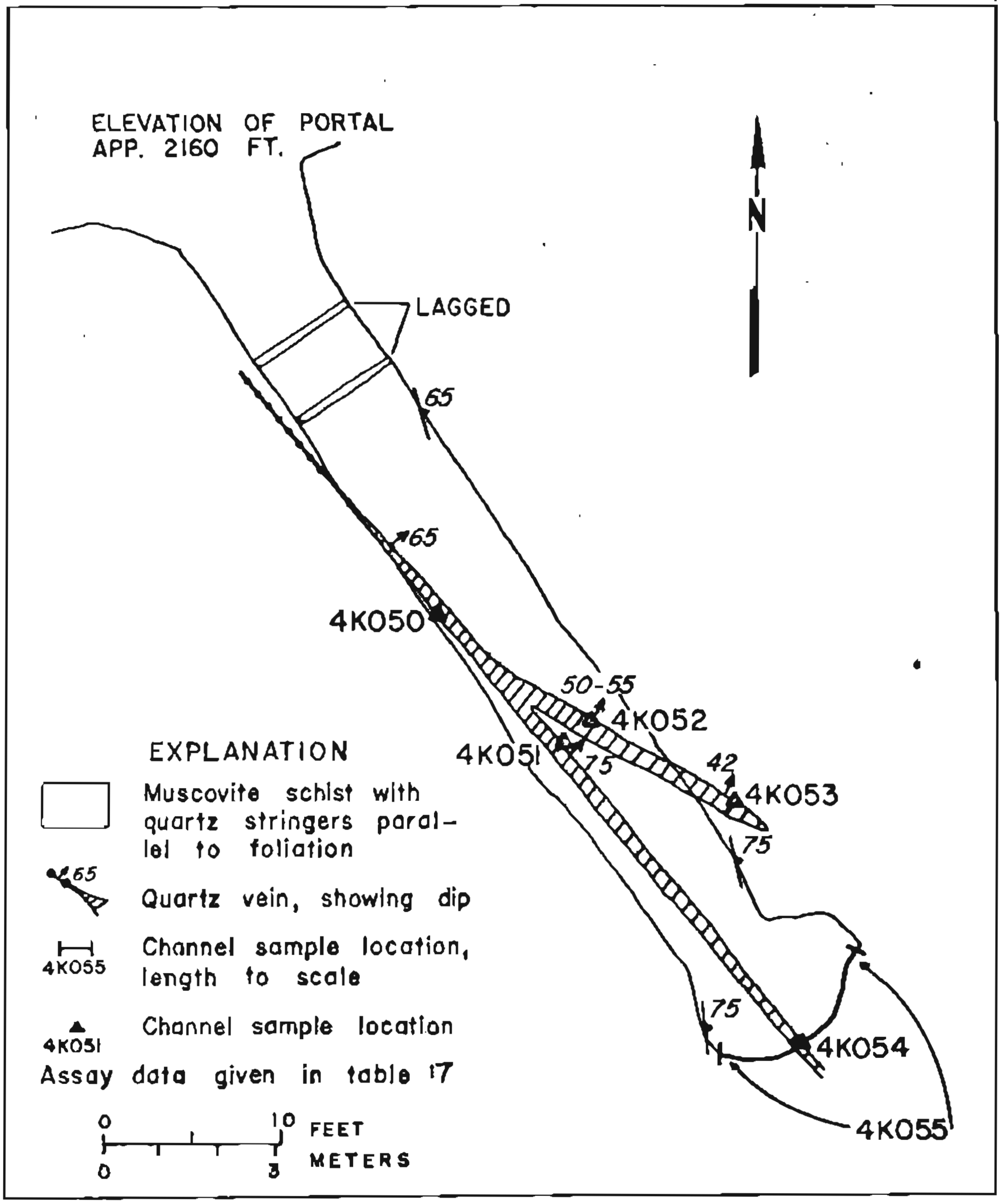


Figure 38.--Yates adit, sample locations

Figure 38.--Yates adit, sample locations.



Mapped by A. Kimball and M. A. Parke, July 1974

Figure 39.-- Jackson adit, sample locations

Figure 39.--Jackson adit, sample locations.

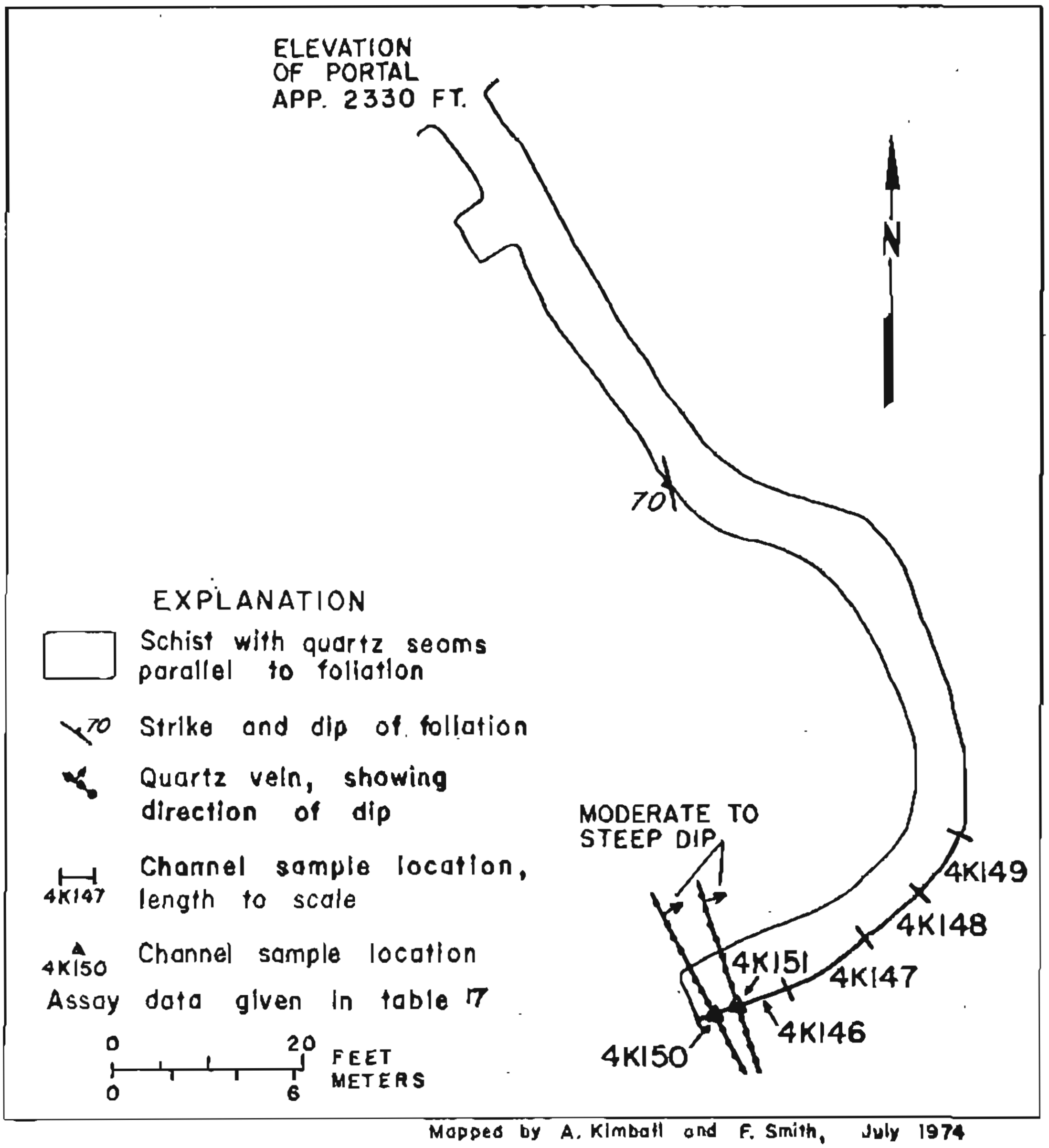
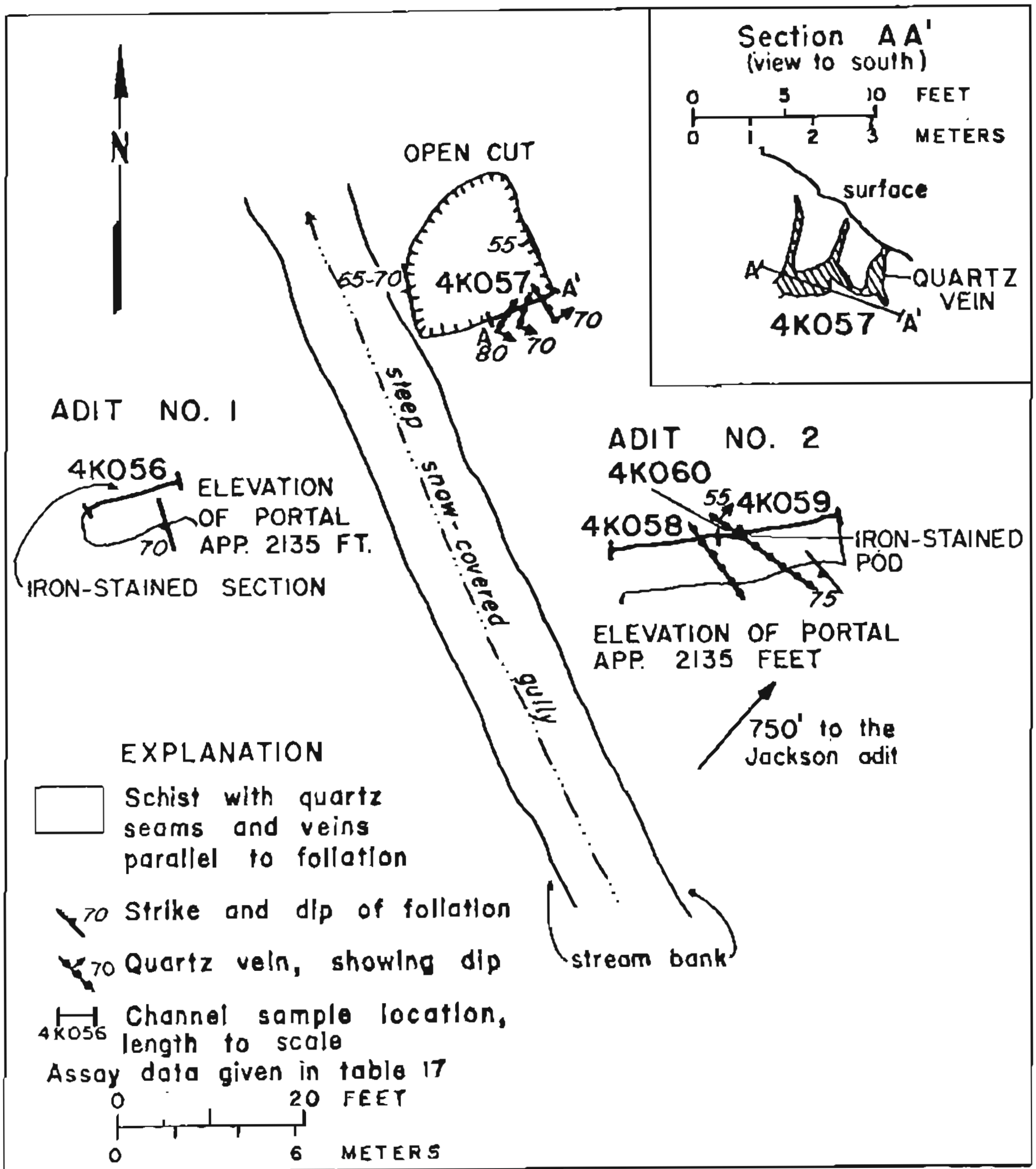


Figure 40.-- Keith adit, sample locations

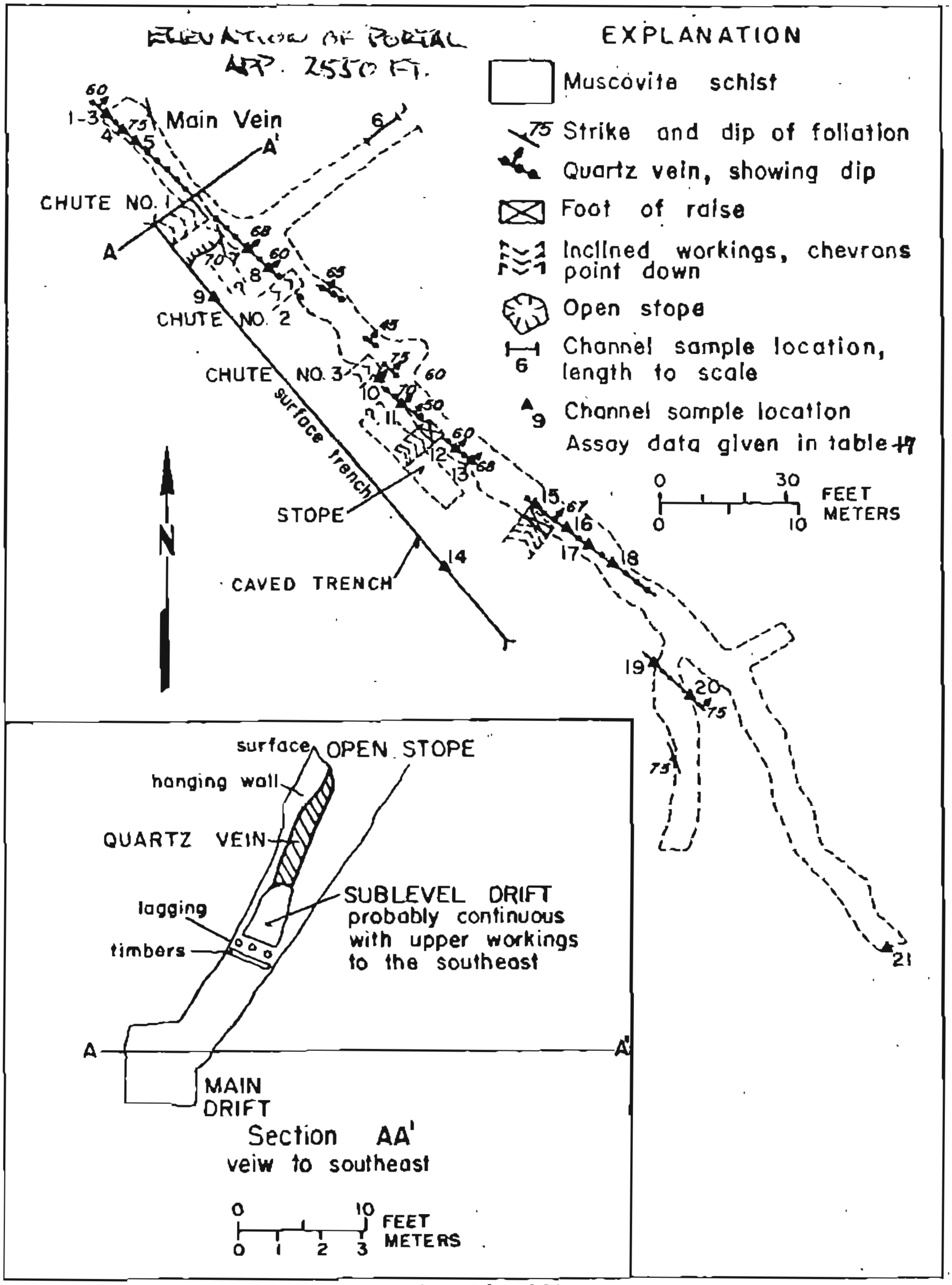
Figure 40.--Keith adit, sample locations.



Mapped by A. Kimball and M. A. Parke, July 1974

Figure 41.-- Yellow Jacket workings, sample locations

Figure 41.--Yellow Jacket workings, sample locations.



Mapped by A. Kimball and M. Parke, July 1974

Figure 42. -- Jensen adit, sample locations

Figure 42.--Jensen mine, sample locations.

Table 17.--Assay data, Spencer's second zone of mineralization.

	Sample 1/	Type	Length Ft.	(m)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption ppm Au	Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
						Fries workings						
1 2/	(4K007)	Channel	10.0	(3.0)	L	N	20	15	50	--	--	Brown coated quartzose chlorite schist with considerable iron staining and quartz banding parallel to foliation.
2	(4K009)	do.	10.0	(3.0)	L	N	45	10	45	--	--	do.
3	(4K039)	do.	.6	(.18)	N	N	L	5	30	--	--	Quartz vein.
4	(4K009)	do.	10.0	(3.0)	N	N	70	15	40	--	--	Brown coated quartzose chlorite schist with considerable iron staining and quartz banding parallel to foliation.
5	(4K010)	do.	10.0	(3.0)	N	N	60	15	45	--	--	do.
6	(4K011)	do.	10.0	(3.0)	L	N	65	15	50	--	--	do.
7	(4K012)	do.	9.0	(2.7)	N	N	40	10	120	--	--	do.
8	(4K013)	do.	11.0	(3.4)	N	N	35	10	70	--	--	Light brown muscovite schist with some quartz veins parallel to foliation.
9	(4K014)	do.	10.0	(3.0)	0.5	N	45	10	60	--	--	do.
10	(4K015)	do.	10.0	(3.0)	.5	N	30	10	60	--	--	do.
11	(4K016)	do.	10.0	(3.0)	N	N	25	5	35	--	--	do.
12	(4K017)	do.	10.0	(3.0)	N	N	10	5	30	--	--	do.
13	(4K018)	do.	10.0	(3.0)	.5	N	20	15	15	--	--	do.
14	(4K019)	do.	10.0	(3.0)	L	N	40	5	15	--	--	do.
15	(4K020)	do.	10.0	(3.0)	.5	N	80	5	75	--	--	do.
16	(4K021)	do.	10.0	(3.0)	N	N	25	10	30	--	--	do.
17	(4K022)	do.	5.0	(1.5)	L	N	40	10	55	--	--	Light brown schist with less quartz than to the northeast.
18	(4K023)	do.	12.0	(3.7)	.7	N	280	15	140	--	--	do.
19	(4K037)	do.	.3	(.09)	N	N	15	10	50	--	--	Quartz vein.
20	(4K038)	Selected grab	-	-	.7	N	130	30	260	--	--	High-grade selection of rock sampled by 4K023.
21	(4K024)	Channel	10.0	(3.0)	.7	L	720	15	130	N	1.0	Light brown schist with less quartz than to the northeast.

1/ Samples 4K144, 4K319-320 were taken in the area and did not contain any significant metal values.
2/ Refer to figure .

Table 17.--Assay data, Spencer's second zone of mineralization, continued.

	Sample	Type	Length Ft.	(m)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption ppm Au	Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
22	(4K025)	Channel	13.0	(4.0)	N	N	60	15	110	N	4.5	Brown to rusty muscovite schist with quartz banding parallel to foliation.
23	(4K026)	do.	10.0	(3.0)	N	N	30	10	55	--	--	do.
24	(4K027)	do.	10.0	(3.0)	N	0.10	20	15	55	N	5.1	Includes a 0.8-ft. thick quartz vein.
25	(4K028)	do.	10.0	(3.0)	N	N	20	10	45	--	--	Brown muscovite schist with quartz lenses parallel to foliation.
26	(4K029)	do.	10.0	(3.0)	N	N	15	15	70	--	--	do.
27	(4K030)	do.	10.0	(3.0)	N	N	30	10	50	--	--	do.
28	(4K031)	do.	10.0	(3.0)	N	N	45	15	80	--	--	Brown to rusty muscovite schist with quartz banding parallel to foliation.
29	4K032)	do.	10.0	(3.0)	N	N	35	10	70	--	--	do.
30	(4K033)	do.	10.0	(3.0)	N	N	35	10	65	--	--	Black chlorite schist with muscovite, graphite and pyrite. Sparse quartz banding parallel to foliation.
31	(4K034)	do.	10.0	(3.0)	N	N	45	10	55	--	--	do.
32	(4K035)	do.	10.0	(3.0)	N	N	40	10	50	--	--	do.
33	(4K036)	do.	12.0	(3.7)	N	N	25	10	20	--	--	do.
						Falls Quartz adit						
	4S097	Channel.	3.9	(1.2)	N	0.10	35	15	55	--	--	Quartz stringer zone in schist.
	4S099	do.	.1	(.03)	N	N	15	25	190			Quartz vein.
	4S101	do.	.6	(.2)	0.5	N	L	5	40	--	--	do.
						Marty mine						
1 3/	(4K071)	Chip	0.5	(0.2)	N	N	L	10	10	--	--	Quartz vein.
2	(4K070)	do.	0.4	(0.1)	150	2.15	10	6300	5100	N	19.9	do.
3	(41-P66)	Spaced chip, 1-ft. interval	172	(52.4)	-	-	-	-	-	.2	L	Dark schist with some quartz stringers.
4	(40-P66)	do.	73	(22.3)	-	-	-	-	-	N	N	Massive gray schist with few quartz stringers.
5	(39-P66)	do.	69	(21.0)	-	-	-	-	-	N	N	Gray schist with local concentrations of quartz stringers.
6	(4S121)	Chip	6.0	(1.8)	N	N	20	15	65	--	--	Dark muscovite schist.

3/ Refer to figure

Table 17.--Assay data, Spencer's second zone of mineralization, continued.

	Sample	Type	Length Ft.	Length (m)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption ppm Au	Atomic Absorption ppm Cu	Atomic Absorption ppm Pb	Atomic Absorption ppm Zn	Fire Assay ppm Au	Fire Assay ppm Ag	Description
7	(4S120)	Chip	10.0	(3.0)	N	N	10	15	55	N	5.1	Dark muscovite schist.
8	(4S119)	do.	10.0	(3.0)	N	N	10	15	50	N	.3	do.
9	(4S118)	do.	10.0	(3.0)	N	N	10	15	60	N	2.4	do.
10	(4S117)	do.	10.0	(3.0)	N	N	10	15	60	--	--	do.
11	(4S116)	do.	10.0	(3.0)	N	N	25	15	65	--	--	do.
12	(4K069)	do.	10.0	(3.0)	N	N	10	15	65	--	--	do.
13	(4K068)	do.	10.0	(3.0)	L	N	30	10	85	--	--	do.
14	(4K067)	do.	10.0	(3.0)	L	N	30	10	85	--	--	do.
15	(4K066)	do.	10.0	(3.0)	N	N	20	10	100	--	--	do.
16	(4K065)	do.	10.0	(3.0)	N	N	25	15	70	--	--	do.
17	(4K064)	do.	10.0	(3.0)	N	N	25	10	60	--	--	do.
18	(4K063)	do.	10.0	(3.0)	L	N	25	10	70	--	--	do.
19	(4K062)	do.	10.0	(3.0)	L	N	45	10	90	--	--	do.
20	(4K061)	do.	10.0	(3.0)	L	N	45	10	90	--	--	do.
21	(4K049)	Spaced chip, 1-ft. interval	10.0	(3.0)	N	N	30	10	90	--	--	Dark schist.
22	(35-P66)	Chip	10.0	(3.0)	-	-	-	-	-	.2	N	Massive gray schist with few quartz stringers.
23	(34-P66)	do.	10.0	(3.0)	-	-	-	-	-	.2	N	Schist with quartz stringers.
24	(33-P66)	do.	10.0	(3.0)	-	-	-	-	-	N	N	do.
25	(32-P66)	do.	10.0	(3.0)	-	-	-	-	-	4	N	do.
26	(31-P66)	do.	10.0	(3.0)	-	-	-	-	-	0.3	N	do.
27	(30-P66)	do.	10.0	(3.0)	-	-	-	-	-	N	1.7	Schist with sparse quartz stringers.
28	(29-P66)	do.	10.0	(3.0)	-	-	-	-	-	N	N	
29	(38-P66)	do.	34	(10.4)	-	-	-	-	-	N	N	Dark schist or schist with quartz stringers or dark fissile schist.
30	(4S122)	do.	10.0	(3.0)	N	N	10	10	25	--	--	Gray muscovite schist with local concentrations of quartz stringers.
31	(4S123)	do.	10.0	(3.0)	N	N	10	5	20	--	--	do.
32	(4S124)	do.	10.0	(3.0)	.5	N	60	45	400	--	--	do.
33	(4S125)	do.	10.0	(3.0)	.7	N	140	35	190	--	--	do.

Table 17.--Assay data, Spencer's second zone of mineralization, continued

	Sample	Type	Length Ft.	Length (m)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption ppm Au	Atomic Absorption ppm Cu	Atomic Absorption ppm Pb	Atomic Absorption ppm Zn	Fire Assay ppm Au	Fire Assay ppm Ag	Description
34	(4S126)	Chip	10.0	(3.0)	.7	N	140	10	95	--	--	Gray muscovite schist with local concentrations of quartz stringers.
35	(4S127)	do.	10.0	(3.0)	L	N	20	10	65	--	--	do.
36	(4S128)	do.	7.0	(2.1)	N	N	30	10	50	--	--	do.
37	(37-P66)	Spaced chip, 1-ft. interval	60	(18.3)	-	-	-	-	-	N	N	Schist with few quartz stringers.
38	(36-P66)	Chip	13.0	(4.0)	-	-	-	-	-	N	N	Massive gray schist with few quartz stringers.
39	(4K042)	do.	10.0	(3.0)	3	N	L	5	10	--	--	Light schist, sericitic and quartoze, with small quartz seams.
40	(4K041)	do.	10.0	(3.0)	L	N	30	10	20	--	--	do.
41	(4K040)	do.	10.0	(3.0)	1.5	N	35	10	N	--	--	Slightly iron-stained schist with quartz boudins and seams.
42	(4K043)	do.	10.0	(3.0)	L	N	15	10	20	--	--	Iron-stained schist.
43	(4K044)	do.	10.0	(3.0)	L	N	10	10	10	--	--	Schist with quartz pods and seams parallel to foliation.
44	(4K045)	do.	10.0	(3.0)	N	N	10	10	25	--	--	Green schist with quartz pods.
45	(4K046)	do.	10.0	(3.0)	N	N	10	10	30	--	--	Schist with quartz seams and some pyrite.
46	(4K047)	do.	10.0	(3.0)	.5	N	45	10	340	--	--	do.
47	(4K048)	do.	9.0	(2.7)	L	N	160	10	210	--	--	do.
					Unnamed workings near Marty							
	4S143	Channel	6.6	(2.0)	N	0.05	30	10	75	--	--	Quartz stringers in schist.
	4S144	do.	0.7	(0.2)	0.5	N	45	10	30	--	--	Schist with quartz stringers.
	4S145	do.	0.7	(0.2)	N	N	N	N	N	--	--	Quartz vein.
	4S147	do.	3.5	(1.1)	N	N	L	10	25	--	--	do.
					Yates adit							
	4KI08	Channel	9.0	(2.7)	0.5	0.05	25	40	75	N	4.5	Brown schist with irregular quartz pods and stringers
	4KI09	do.	8.0	(2.4)	N	N	20	5	30	--	--	Light brown schist with thin quartz stringers parallel to foliation.

Table 17.--Assay data, Spencer's second zone of mineralization, continued.

Sample	Type	Length Ft.	Length (m)	Semiquantitative Spectrographic Analysis ppm Ag	Au	Atomic Absorption ppm Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
4K110	Channel	9.0	(2.7)	L	L	90	5	20	N	.7	Brown schist with irregular quartz seams and stringers.
4K111	do.	6.5	(1.2)	L	L	20	10	70	--	--	do.
4K112	do.	3.2	(1.0)	L	N	30	10	250	--	--	Brown schist with a few irregular quartz seams and stringers.
4K113	do.	.4	(.1)	N	N	L	5	L	--	--	Iron-stained quartz vein with pyrite cubes.
4K114	do.	.25	(.08)	N	N	15	10	15	--	--	Slightly iron-stained quartz vein with pyrite cubes.
4K115	do.	.16	(.05)	N	N	L	15	15	--	--	Quartz vein.
4K116	Selected grab	-	-	30	19.0	L	28000	3500	--	--	High grade selection of schist with small quartz stringers and knots of galena. Mineralization has no distinct attitude.
					Jackson adit						
4K050	Channel	.5	(.2)	N	N	L	5	20	N	5.5	Quartz vein.
4K051	do.	.4	(.1)	N	N	5	10	45	--	--	do.
4K052	do.	.7	(.2)	N	N	5	L	10	--	--	do.
4K053	do.	.7	(.2)	N	N	20	25	20	--	--	do.
4K054	do.	.3	(.09)	N	2.5	5	5	75	--	--	do.
4K055	do.	10.0	(3.0)	0.5	.25	20	10	80	N	6.2	Muscovite schist with minor quartz stringers parallel to foliation, sampled across face of adit.
					Keith adit						
4K146	Channel	10.0	(3.0)	0.5	0.35	20	55	80	2.4	4.1	Dark schist with thin quartz seams parallel to foliation.
4K147	do.	10.0	(3.0)	1.5	.10	15	20	60	--	--	do.
4K148	do.	7.5	(2.3)	N	L	20	45	45	--	--	do.
4K149	do.	9.5	(2.9)	L	.05	45	35	55	--	--	do.
4K150	do.	.4	(.1)	N	N	10	10	90	--	--	Quartz vein.
4K151	do.	.3	(.09)	N	20	15	15	20	5.8	.3	do.

Table 17.--Assay data, Spencer's second zone of mineralization, continued.

	Sample	Type	Length Ft.	Length (m)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption ppm Au	Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
						Yellow Jacket workings, adit #1						
	4K056	Channel	11.0	(3.4)	0.7	0.05	55	15	220	0.3	L	Iron-stained schist with quartz seams parallel to foliation.
						Yellow Jacket workings, open cut						
	4K057	Channel	8.0	(2.4)	L	0.10	40	15	60	1	L	Irregularly foliated schist with quartz veins.
						Yellow Jacket workings, adit #2						
	4K058	Chip	12.0	(3.7)	0.5	N	60	20	350	--	--	Schist with quartz vein and seams.
	4K059	do.	13.0	(4.0)	.7	N	85	20	110	--	--	do.
	4K060	do.	.4	(.1)	L	N	65	30	65	--	--	Quartz vein with rusty angular pod.
						Jensen mine						
1 4/	(4K184)	Channel	.3	(.09)	N	L	20	20	70	N	4.1	Iron-stained schist, foot wall.
2	(4K183)	do.	.3	(.09)	N	.20	25	30	190	N	3.4	Iron-stained schist, hanging wall.
3	(4K182)	do.	.7	(.2)	7	61.0	L	1900	30	81.9	17.8	Quartz vein.
4	(4K181)	do.	.8	(.2)	N	3.5	L	35	110	17.8	3.4	do.
5	(4K180)	do.	.6	(.2)	1	12.0	L	690	650	7.5	4.1	do.
6	(4K185)	Spaced chip, 0.5-ft. interval	10	(3.0)	.5	.05	35	20	45	N	4.1	Muscovite schist with quartz stringers parallel to foliation.
7	(4K179)	Channel	.6	(.2)	N	N	L	10	65	.7	3.8	Quartz vein.
8	(4K178)	do.	.8	(.2)	N	N	L	5	10	--	--	do.
9	(4K145)	do.	.65	(.2)	10	99.0	L	4000	5	585.5	108.3	Iron-stained quartz vein with small galena pods and free gold.
10	(4K177)	do.	.5	(.2)	N	N	5	5	20	N	.7	Quartz vein.
11	(4K176)	do.	.6	(.2)	N	.10	L	5	L	.3	4.5	do.
12	(4K175)	do.	.3	(.09)	3	42.0	10	2000	350	14.7	10.3	do.
13	(4K174)	do.	.5	(.2)	N	.10	L	5	5	N	3.4	do.
14	(4K006)	do.	1.2	(0.4)	N	N	5	L	20	N	N	Iron-stained quartz vein with small galena pods and free gold.

4/ Refer to figure

Table 17.--Assay data, Spencer's second zone of mineralization, continued

	Sample	Type	Length Ft.	Length (m)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption ppm Au	Atomic Absorption ppm Cu	Atomic Absorption ppm Pb	Atomic Absorption ppm Zn	Fire Assay ppm Au	Fire Assay ppm Ag	Description
15	(4K158)	Channel	.6	(.2)	.5	.50	20	130	110	11.7	5.5	Galena knot noted.
16	(4K157)	do.	.5	(.2)	N	N	5	5	5	2.40	.3	Quartz vein.
17	(4K156)	do.	.6	(.2)	N	N	L	L	15	--	--	do.
18	(4K155)	do.	.6	(.2)	N	N	L	5	25	--	--	do.
19	(4K153)	do.	.2	(.06)	N	N	10	5	35	--	--	do.
20	(4K152)	do.	.25	(.08)	N	N	L	N	10	--	--	do.
21	(4K154)	do.	6.0	(1.8)	N	N	25	5	70	--	--	Muscovite schist with small amount of quartz.

The Jensen mine is located at an elevation of 2,550 feet on the north side of Spruce Mountain on the Fairview claim. The main drift is driven on a series of gold-bearing quartz veins, each about 0.5 foot to 1.5 feet thick. The series can be traced on the surface for at least a hundred feet. R. V. Rowe held the Fairview claim in 1922 and drove an 80-foot crosscut into a high-grade quartz stringer (Buddington, 1923, p. 126). By 1925, according to an unpublished Jacob Marty Mines report (Willis, 1926, p. 10), a 50-foot crosscut had been driven into the main vein and 40 feet of drift driven along the strike. In 1927, the main drift was driven to its present length of 275 feet. An aerial tramway was installed from the mine to the Marty mill, and 118 tons of hand-sorted ore was run through the mill with a recovery of $1,100 in gold (Willis, 1926, 1927 Supplement). Based on confidential information, a small additional production came from this property. The mine appears to have been abandoned for over 40 years.

The map was examined, mapped and sampled in 1974. The portal area was sloughed in and it was evident the workings had not been entered for years. The main drift was driven on a series of quartz veins 0.5 foot to 1.5 feet thick bearing pyrite, pyrrhotite, galena, sphalerite and occasionally free gold. The dip of these veins is opposite to that of the schist in the area. Figure 42 is a mine and sample location map and table 17 gives the assay returns. Based on eight samples, 68 feet along the main vein had an average assay of 0.05 ounces gold per ton over a 4-foot stoping width. The vein system was sampled over a length of 275 feet.

The main vein was sampled at two locations on the surface. One sample assayed 16.98 ounces gold per ton over a width of 0.65 feet or 2.77 ounces gold per ton converted to a 4-foot stoping width. Another sample 97 feet to the southeast along the vein contained no gold. This ore assay appears to be a remnant of a mined-out high-grade pocket. Isolated high-grade pockets of ore seem to be characteristic of this deposit.

Based on the assayed sample results of the underground workings the mine does not have economic potential at the present price of gold.

The early reports (Willis, 1926; Palmer, 1937) of large reserves of moderate grade ore extending from the Fries adit on the south side of Spruce Creek to the summit of Spruce Mountain were not substantiated by this investigation. The results of this investigation were similar to the 1938 investigation of the Marty Mines Group by Joe A. Williams, of the Alaska-Juneau Gold Mining Company. His unpublished report states:

> "These ore deposits [Marty Group] bear no resemblance to the Alaska-Juneau either structurally, mineralogically, or economically and could not even be hand sorted on account of the smallness of the veins and the friability of the country rock."

Spotty, high-grade pockets of ore are characteristic of these deposits and probably most of those exposed on the surface have been mined out. Underground high-grade ore pockets will be difficult to locate.

Spencer's third zone of mineralization in the Windham Bay area

Spencer's third zone of mineralization extends from Spruce Creek at an elevation of 2,500 feet to the south side of Spruce Mountain. The Apache-Navajo prospect, iron-stained zones between the Apache-Navajo prospect and the summit of Spruce Mountain, Gold Shaft prospect, altered zone south of Spruce Mountain and claims at the head of Sylvia Creek are located within this mineralized area (fig. 43). The stained zones have/ base and

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Figure 43 near here.

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precious metals values that suggest further investigation may be warranted.

The Spruce Mountain area contains sericitic alteration similar to that found in the southeastern Sumdum Glacier mineral belt and is located near a magnetic anomaly not far to the south.

Apache-Navajo prospects

The Apache and Navajo claims were patented in 1909 by Windham Chief Gold Mining Company. They are located at the head of Spruce Creek. As of 1903, two adits 60 feet and 80 feet long, and a two-stamp mill were reported on the Apache-Navajo claims (Spencer, 1906, p. 41). Work on these claims ceased in 1903 because of the low grade of ore. Apparently little work has been done in this area since.

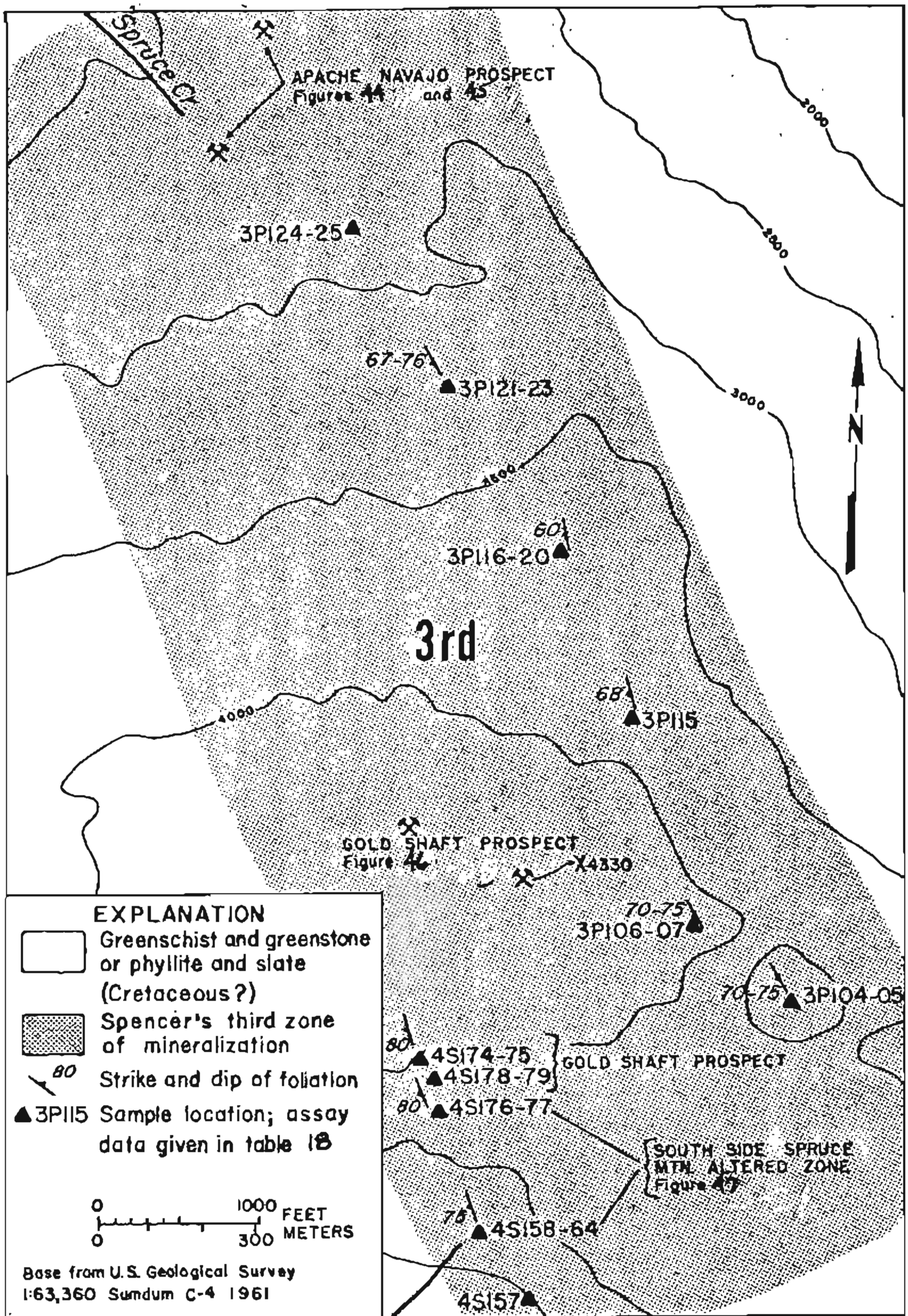


Figure 43-Spencer's third zone of mineralization, prospect and sample locations

Figure 43.--Spencer's third zone of mineralization, prospect and sample locations.

The two adits were driven on quartz veins. Figures 44 and 45 show

Figures 44 and 45 near here.

the adits, and table 18 gives the sample assay results. There were no

TABLE 18 near here.

significant metal values present and only a trace of gold and silver were found in both of the adits.

Iron-stained zones between the Apache-Navajo prospect and the summit of Spruce Mountain

There are several stained zones located in the area between the Apache-Navajo prospect and the summit of Spruce Mountain. These zones follow the foliation of schists in the area and are marked by limonite staining. Eighteen spaced chip samples were taken across the zones. Figure 43 shows the sample locations and table 18 gives the analytical results. Four of the 18 samples gave the following results: sample 3P116, a 100-foot chip, contained 5 ppm silver, 1300 ppm lead and 7600 ppm zinc; 3P123, a 17-foot-long chip, contained 3 ppm silver, 0.05 ppm gold and 1900 ppm zinc; 3P125, a 105-foot long chip, assayed at 3 ppm silver, 0.05 ppm gold, 390 ppm copper, 60 ppm lead and 2100 ppm zinc; and 3P107, a 50-foot-long chip, contained 2 ppm silver, 170 ppm lead and 1000 ppm zinc. All the remaining samples were anomalous in silver, gold, lead or zinc, but in much lesser amounts than the above. The mineralized zones appear to extend at least 300 to 600 feet across the surface, much of which is inaccessible due to ruggedness of terrain and snow cover. The area may warrant exploration.

Table 18.--Assay data, Spencer's third zone of mineralization

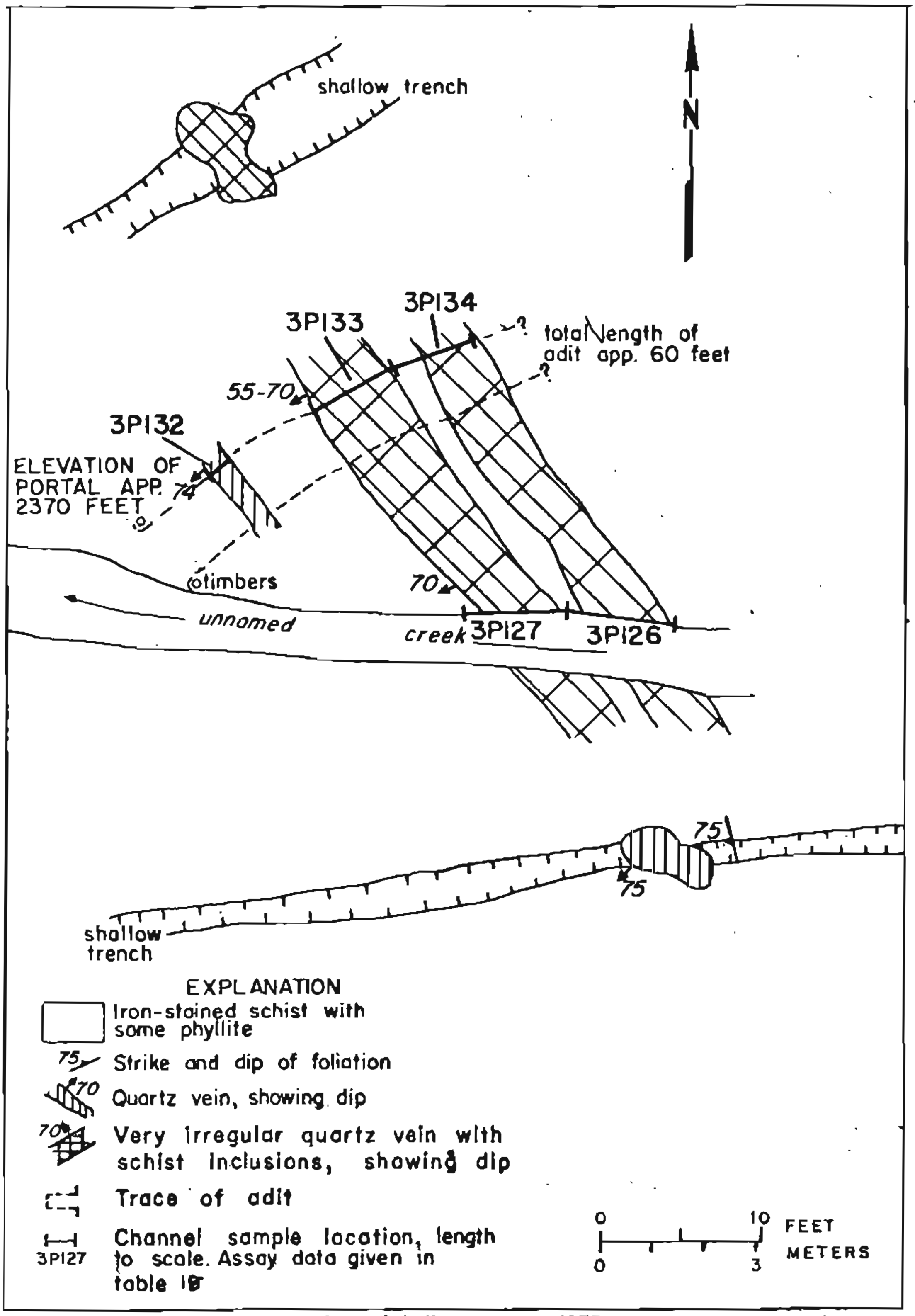
Sample	Type	Length Ft.	Length (m.)	Semiquantitative Spectrographic Analysis ppm Ag	As	Atomic Absorption ppm Au	Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
						Apache-Navajo prospect - south adit						
3P129	Channel	5.0	(1.5)	0.5	500	L	30	10	45	N	0.3	Schist with quartz stringers and vein.
3P131	do.	7.0	(2.1)	.5	500	L	60	15	85	N	2.4	Muscovite schist with quartz.
						Apache-Navajo prospect - open cut						
3P128	do.	4.8	(1.5)	0.5	500	L	65	15	85	-	-	Schist with quartz with minor pyrite.
						Apache-Navajo prospect - north adit						
3P126	do.	6.5	(2.0)	L	N	-	30	10	110	-	-	Quartz vein.
3P127	do.	6.5	(2.0)	L	2000	N	30	10	90	N	.3	Schist with quartz stringers, hanging wall of vein.
3P132	do.	1.7	(.5)	N	500	N	20	10	45	N	.3	Quartz vein.
3P133	do.	5.2	(1.6)	0.7	300	N	60	15	160	-	-	Black phyllite with quartz.
3P134	do.	5.1	(1.6)	.5	N	L	40	10	160	N	L	do.
						Iron-stained zones between the Apache-Navajo prospect and the summit of Spruce Mountain						
3P104	Composite of cuts	0.1to .8	(0.03to .2)	0.5	N	N	L	5	20	-	-	Quartz veins.
3P105	do.	.1to 3.3	(0.03to 1.0)	L	200	N	5	L	10	-	-	do.
3P106	do.	.1to 1.0	(.03to .4)	L	N	N	40	5	30	-	-	do.
3P107	Spaced chip, 1.0-ft. interval	50	(15.2)	2	200	N	150	170	1000	-	-	Iron-stained schist.
3P115	do.	64	(19.5)	2	N	L	110	55	320	-	-	do.
3P116	Spaced chip, 2.0-ft. interval	100	(30.5)	5	N	L	210	1300	7600	-	-	do.
3P117	do.	100	(30.5)	1	N	N	95	35	260	-	-	do.
3P118	do.	87	(26.5)	.5	N	L	85	20	200	-	-	do.
3P119	Spaced chip, 1.0-ft. interval	18	(5.5)	.5	N	N	90	10	130	-	-	do.
3P120	Spaced chip, 2.0-ft. interval	94	(28.7)	.7	N	0.05	70	30	280	-	-	do.
3P127	Composite chip	20	(6.1)	.5	N	N	25	25	160	-	-	Schist with a quartz vein with small amount of pyrite.

Table 18.--Assay data, Spencer's third zone of mineralization, continued.

Sample	Type	Length		Semiquantitative Spectrographic Analysis ppm		Atomic Absorption ppm				Fire Assay ppm		Description
		Ft.	(m.)	Ag	As	Au	Cu	Pb	Zn	Au	Ag	
						Iron-stained zones between the Apache-Navajo prospect and the summit of Spruce Mountain-continued						
3P122	Spaced chip, 2.0-ft. interval	69	(21.0)	1.5	N	L	85	60	440	-	-	Iron-stained schist with quartz stringers.
3P123	Spaced chip, 1.0-ft. interval	17	(5.2)	3	N	0.05	230	250	1900	-	-	do.
3P124	Spaced chip, 2.0-ft. interval	100	(30.5)	1.5	N	N	65	45	240	-	-	Iron-stained schist.
3P125	do.	105	(32.0)	3	N	.05	390	60	2100	-	-	do.
						Gold shaft prospect						
3P108	Channel	1.5	(.5)	2	10000	0.15	35	350	130	N	1.0	Schist with quartz.
3P109	do.	2.0	(.6)	.05	N	.5	25	30	100	-	-	do.
3P110	do.	3.8	(1.2)	2	N	8.0	35	340	160	-	-	do.
3P111	Spaced chip, 1.0-ft. interval	35	(10.7)	.5	N	.05	20	30	40	-	-	Schist with quartz pods and stringers.
3P112	Channel	1.1	(.3)	1	N	L	35	200	360	-	-	Quartz vein.
3P113	Spaced chip, 1.0-ft. interval	32	(9.8)	.5	N	N	30	45	70	-	-	Iron-stained schist.
3P114	Channel	1.5	(.5)	.5	200	N	15	50	35	-	-	Quartz vein.
4S174	do.	8.0	(2.4)	1	N	.05	N	40	35	N	N	do.
4S175	Selected grab	-	-	30	N	.25	N	8000	200	-	-	High grade selection of galena in 8.0-ft. thick quartz vein.
4S178	Channel	7.0	(2.1)	1.5	N	L	5	210	85	-	-	Quartz vein.
4S179	do.	.5	(.2)	1.5	300	.05	65	310	190	-	-	Wall rock surrounding above vein.
						Altered zone south of Spruce Mountain						
4S158	Spaced chip, 1.0-ft. interval	50	(15.2)	10	N	10	60	1100	140	N	3.1	Iron-stained schist.
4S159	Chip	2	(.6)	.5	N	N	15	210	65	N	3.4	Discontinuous quartz vein or plug.
4S160	Spaced chip, 1.0-ft. interval	25	(7.6)	10	N	10	450	180	65	-	-	Iron-stained schist.
4S161	Chip	2	(.6)	.5	N	N	20	60	45	-	-	Quartz vein.
4S162	Spaced chip, 1.0-ft. interval	44	(13.4)	2	N	.05	75	80	190	-	-	Iron-stained schist.

Table 18.--Assay data, Spencer's third zone of mineralization, continued.

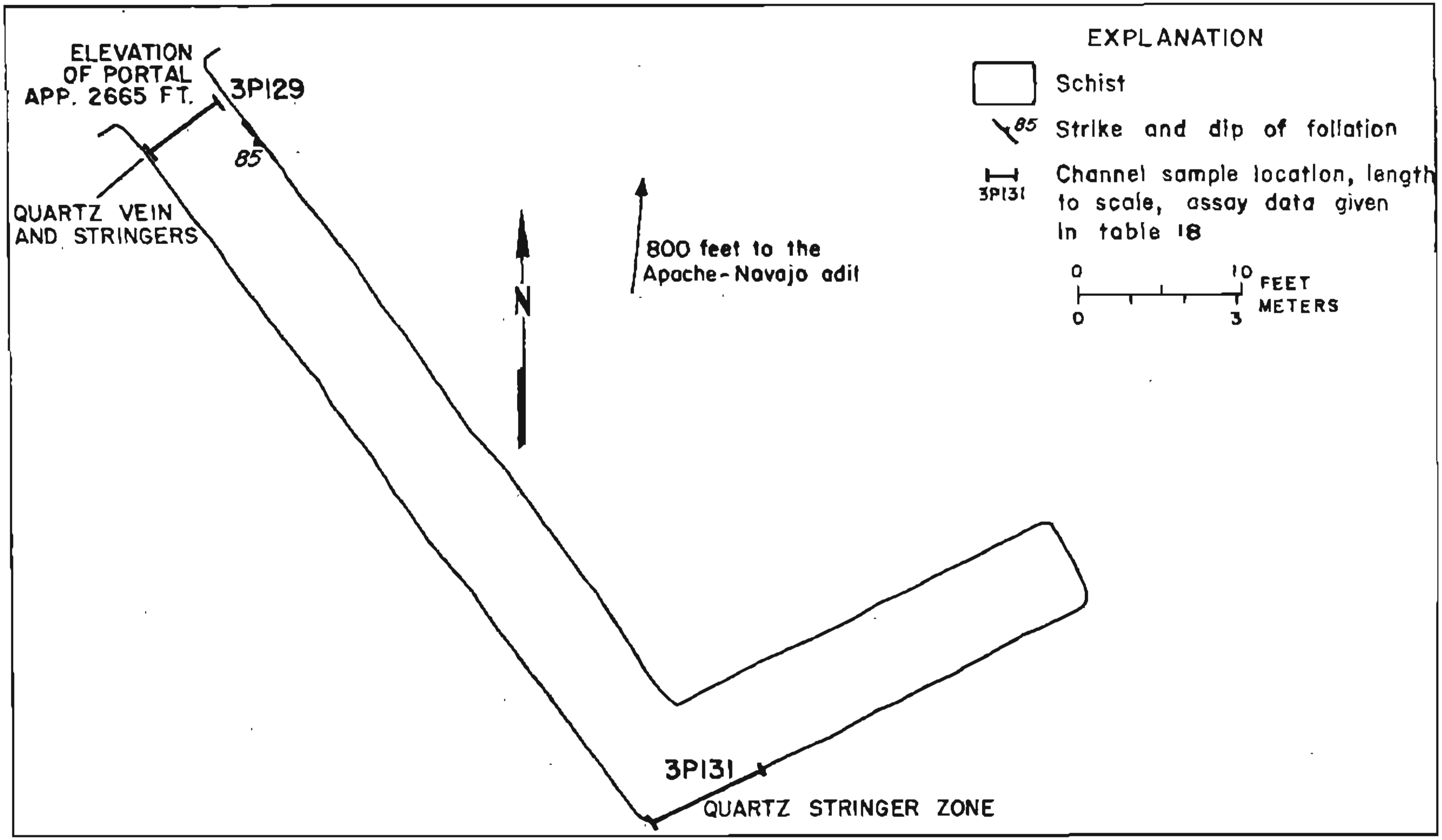
Sample	Type	Length Ft.	Length (m.)	Semiquantitative Spectrographic Analysis ppm Ag	Semiquantitative Spectrographic Analysis ppm As	Atomic Absorption ppm Au	Atomic Absorption ppm Cu	Atomic Absorption ppm Pb	Atomic Absorption ppm Zn	Fire Assay ppm Au	Fire Assay ppm Ag	Description
	Altered zone south of Spruce Mountain-continued											
4S164	Channel	.25	(.08)	150	N	.5	2100	21000	4800	-	-	Quartz vein with sulfides.
4S176	Spaced chip, 1.0-ft. interval	50	(15.2)	2	N	.1	70	70	65	-	-	Iron-stained schist.
4S177	do.	53	(16.2)	2	N	.1	65	270	50	-	-	do.
	Claims at the head of Sylvia Creek											
4S149	Spaced chip, 0.25-ft. interval	10	(3.0)	N	N	N	60	15	75	-	-	Iron-stained gneiss with 1-ft. thick quartz vein.
4S150	Selected grab	-	-	L	N	0.10	60	20	95	-	-	High grade selection from above section.
4S152	Channel	.3	(.09)	N	N	N	20	5	60	-	-	Quartz vein.
4S153	Select grab	-	-	N	N	N	45	10	100	-	-	High-grade selection of pyrite from above vein.
	Other											
4S157	Selected grab	-	-	N	N	N	25	10	40	-	-	Iron-stained schist with sulfides.



Mapped by T. L. Pittman and A. Kimball, August 1973

Figure 44.--Apache-Navajo prospect, north adit, sample locations

Figure 44.—Apache-Navajo prospect, north adit, sample locations.



Mapped by T. L. Pittman and F. Smith, August 1973

Figure 45. -- Apache-Navajo prospect, south adit, sample locations

Figure 45.--Apache-Navajo prospect, south adit, sample locations.

Gold Shaft prospect

Thane (1915, p. 3) reported a 20-foot shaft and a 150-foot-long trench near the summit of Spruce Mountain on the Free Gold group of claims. Apparently there has been very little additional work on these claims after 1915. This area was relocated in the 1930's and early 1940's as the Gold Shaft claims.

Our investigation revealed a flooded 14-foot shaft, four small open-pits, and a 156-foot-long trench. Figure 46 shows the working and

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Figure 46 near here.

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sample locations near the summit of Spruce Mountain. Of seven measured samples taken, one contained significant anomalous results; sample 3P110, a 3.8-foot channel of a quartz vein, assayed 2 ppm silver, 8 ppm gold, and 390 ppm lead. All of the samples were slightly anomalous in silver at 0.5 ppm to 2 ppm.

About 1,000 feet south of the summit of Spruce Mountain and within the Gold Shaft claims, an 8-foot-thick quartz vein appears from under talus at an elevation of 3,900 feet and extends to an elevation of 4,050 feet, where it grades into small stringers and disappears under talus (fig. 43). This vein strikes N. 24° W. with an 80° dip to the southwest and follows the structure of the schist in the area. Only trace amounts of gold and silver were detected in the measured samples taken of this vein; however, a selected grab sample of a 0.1-foot galena pod in the vein assayed 30 ppm silver, 0.25 ppm gold and 8,000 ppm lead.

Altered zone south of Spruce Mountain

A prominent altered zone occurs about 1,500 feet south of the summit of Spruce Mountain in a cirque. Figure 43 gives the location of the altered zone. The Big Diamond and Oregon Girl claims were staked in this vicinity in 1900. This altered zone follows the foliation of the gray schist and is identified by white and yellow schists which contain disseminated sulfides and occasional pods of quartz. Pyrite is the predominant sulfide but pyrrhotite, sphalerite, chalcopyrite and galena were found in small amounts.

This altered zone extends from an elevation of about 3,100 feet to an elevation of 3,900 feet and disappears under scree at both ends. This zone is 120 feet thick at its lower end and 50 feet thick at its upper end. Five spaced chip samples taken across the zone varied in length between 25 feet and 53 feet. Figure 47 is a sample location map, and

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Figure 47 near here.

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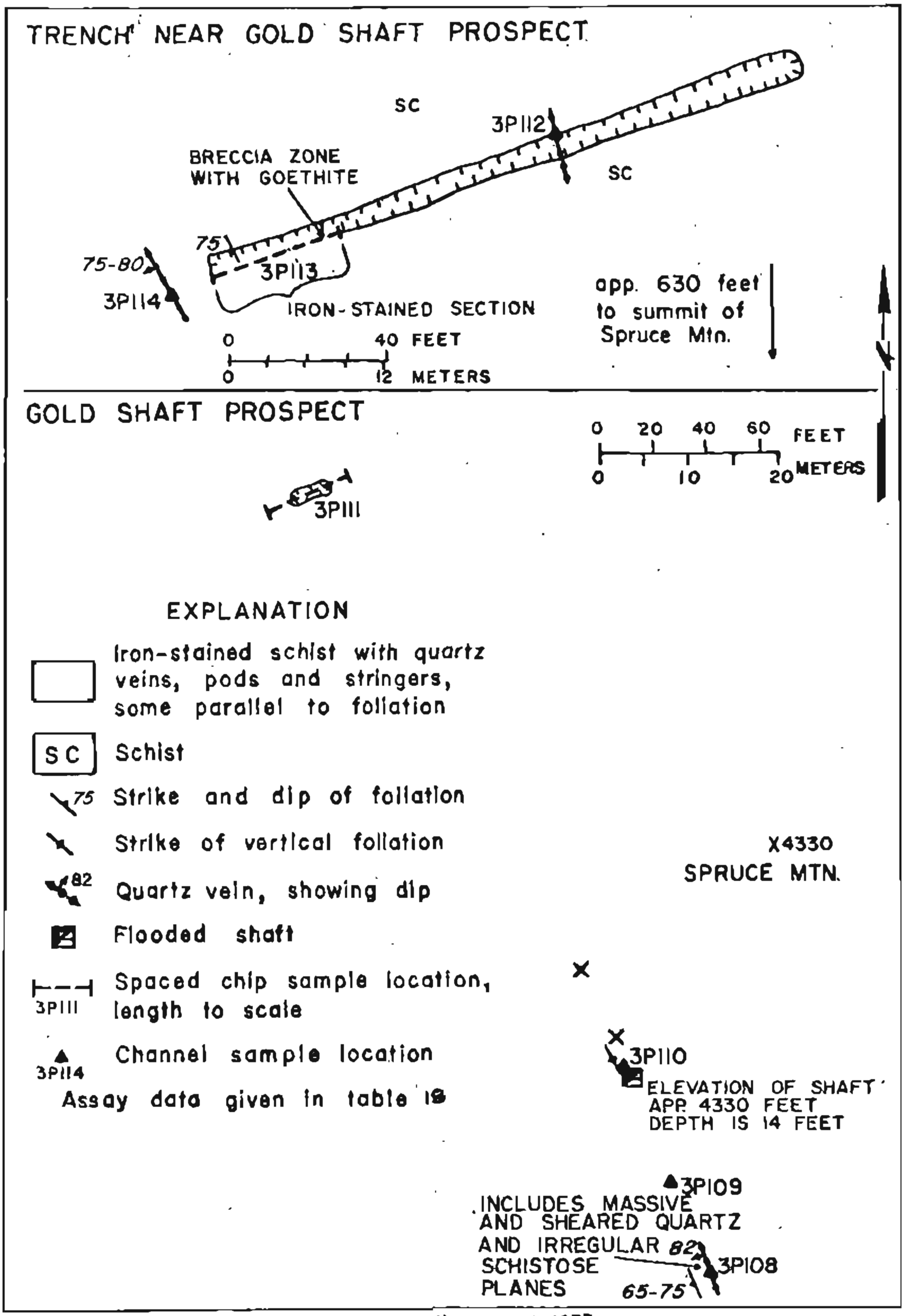
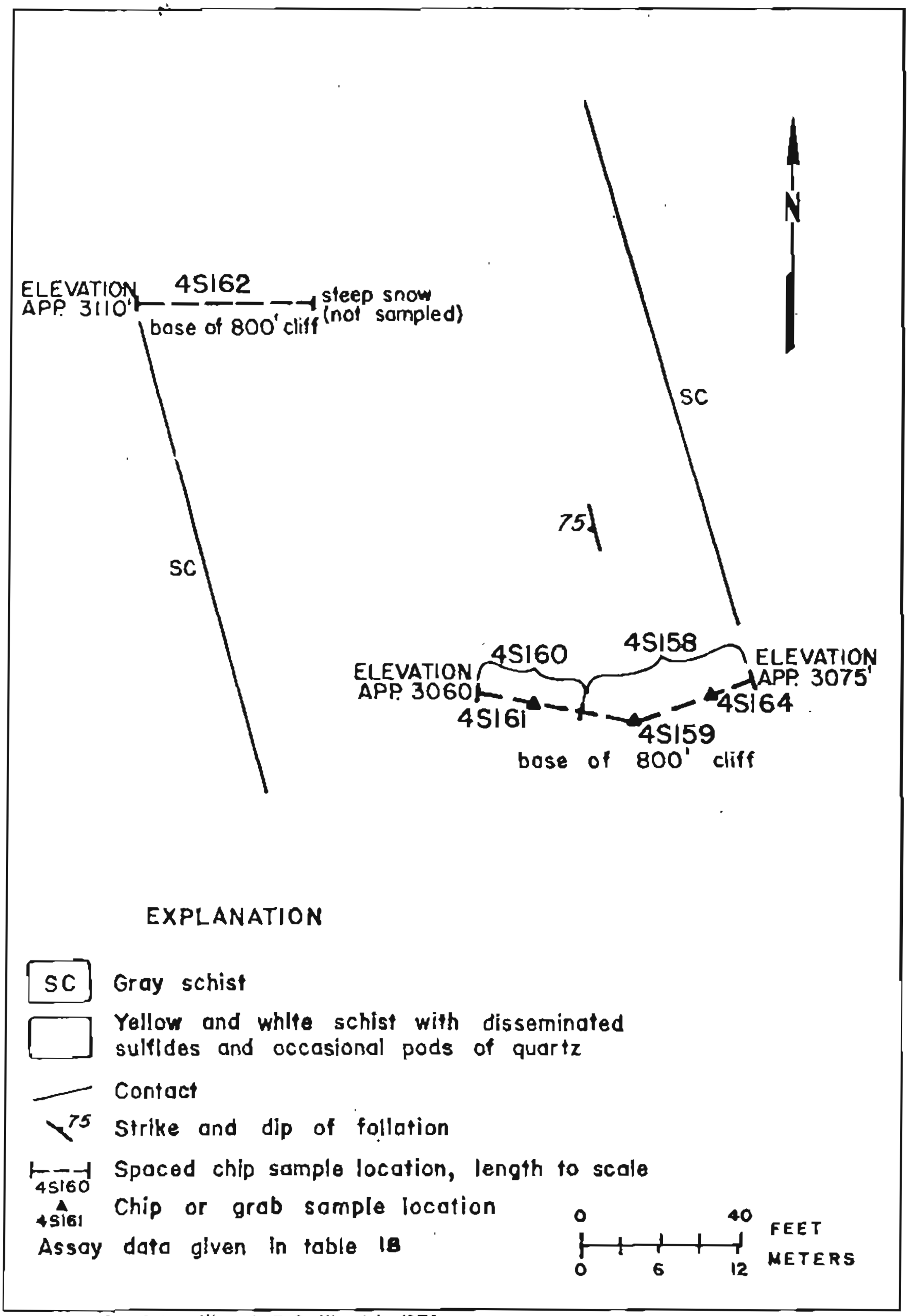
table 18 gives the assay returns. All five samples were anomalous in silver at 0.5 to 10 ppm, in gold at 0.05 to 0.10 ppm, and in lead at 70 ppm to 1100 ppm. Two additional 2-foot-long chip samples across discontinuous quartz veins contained 0.5 ppm silver and 60 and 210 ppm lead; in general, the quartz pods contained lesser amounts of metal than the altered schist. A portion of a 0.25-inch thick vein which contains quartz, galena, chalcopyrite and sphalerite assayed 150 ppm silver, 0.5 ppm gold, 2100 ppm copper, 21,000 ppm lead, and 4800 ppm zinc; however, converted to a 4-foot width the values would only be half of one percent of those given.



Mapped by T. L. Pittman and A. Kimball, August 1973

Figure 46.-- Workings near the summit of Spruce Mountain, sample locations

Figure 46.--Workings near the summit of Spruce Mountain, sample locations.



Mapped by J. C. Still and F. Smith, July 1974

Figure 47.--South side of Spruce Mountain, sample locations

Figure 47.--South side of Spruce Mountain, sample locations.

Claims at the head of Sylvia Creek

The Bear Lode, Margaruita, Alice and Eclipse claims were staked in 1899 near the head of Sylvia Creek about 1 mile east of the above mentioned altered zone. Although there is not enough information to accurately locate these claims (location on pl. 3), an investigation was made of this area. Mineralization consists primarily of disseminated iron sulfides associated with stringer zones of quartz in gneiss. A 10-foot chip sample taken across a stained zone, 4S149, and a 0.3-foot channel across a quartz vein resulted in no anomalous values (table 18). Plate 3 shows the sample locations. However, a selected grab sample from the portion of the stained zone with the most concentrated sulfides gave 0.10 ppm gold.

Chuck River lode

The X-ray claims were located in 1905 just northeast of the mouth of the Chuck River on a peninsula known as Mineral Point. A 23-foot-long adit about 4,500 feet south of the mouth of the Chuck River near the base of the peninsula may be related to these claims. A 23-foot-long chip sample (4K117) taken along the length of the adit contained 0.05 ppm silver and 70 ppm lead. A 30-foot-long channel sample (4K123) taken across an altered schist in the area containing disseminated sulfides contained 0.05 ppm gold. A selected grab sample of iron-stained quartz fragments contained 1 ppm silver. Figure 48 shows the sample locations and table 19 gives the analytical data.

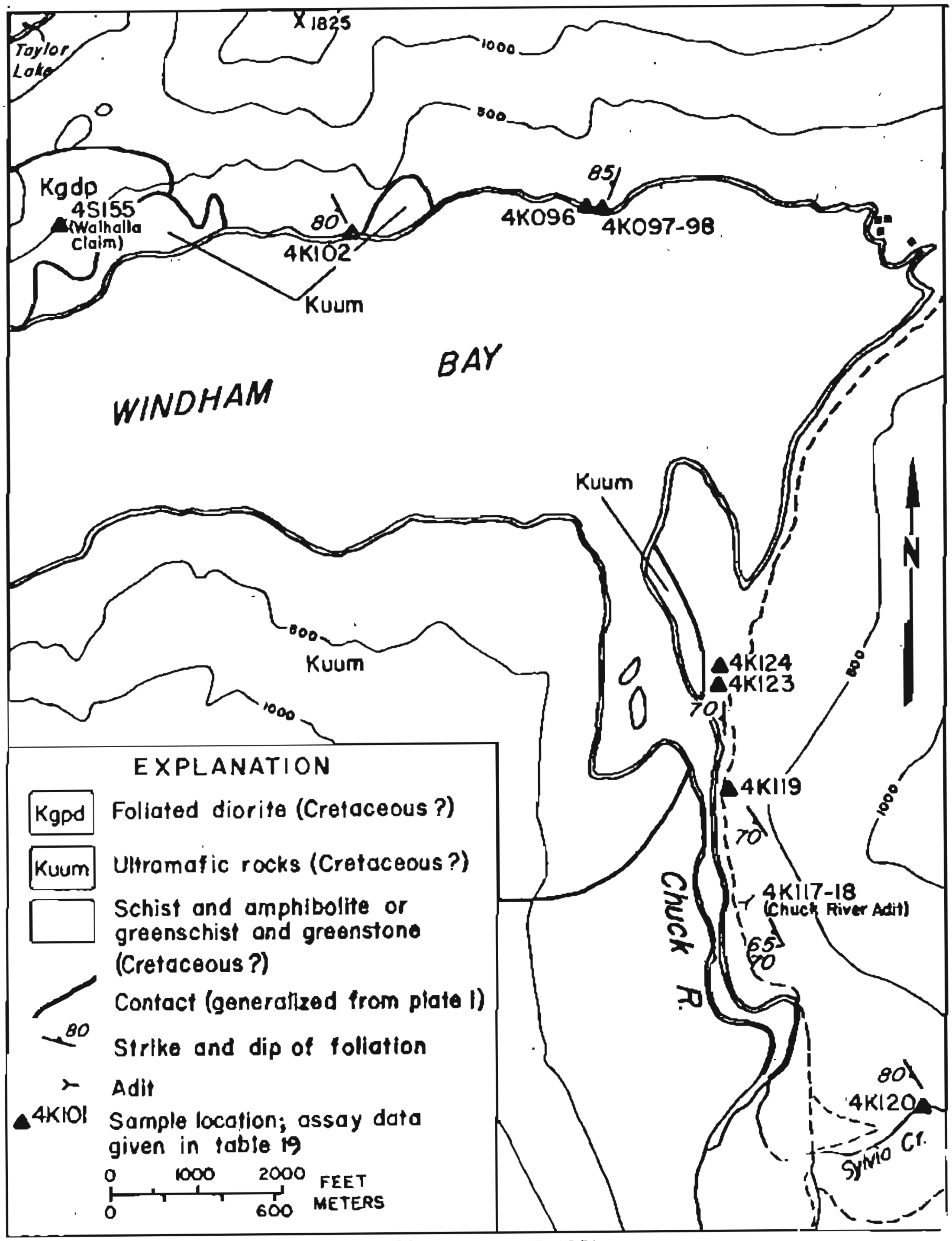
Figure 48 near here.

TABLE 19 NEAR HERE.

Table 19.--Assay data, North shore of Windham Bay and Chuck River lodes.

Sample	Type	Length Ft.	Length (m)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption ppm Au	Atomic Absorption ppm Cu	Atomic Absorption ppm Pb	Description
				North shore of Windham Bay				
4K096	Selected grab	-	-	N	N	280	55	1.5-ft. thick quartz-calcite breccia zone with pyritic blebs.
4K097	Chip	26.0	(7.9)	N	N	110	20	Slightly iron-stained biotite schist with traces of pyrite.
4K098	do.	25.0	(7.6)	N	N	85	15	do.
4K102	do.	10.0	(3.0)	N	N	5	20	Iron-stained schist.
4S1551/	Spaced chip, 0.5 ft. interval	28	(8.5)	0.7	N	25	5	Iron-stained diorite.
				Chuck River lodes				
4K117	do.	23	(7.0)	0.5	N	45	70	Green-brown phyllite with quartz parallel to foliation.
4K118	Channel	.3	(.1)	L	N	15	45	Iron-stained quartz vein with knots of pyrite.
4K119	Channel	.3	(.1)	L	N	15	L	Iron-stained quartz vein with a considerable amount of pyrite.
4K120	Selected grab	-	-	N	N	35	10	Quartz from pods and veinlets, trace of pyrite.
4K123	Channel	30.0	(9.1)	N	0.05	10	10	Iron-stained chorite-muscovite schist with a trace of pyrite.
4K124	Selected grab	-	-	1	N	L	L	Iron-stained quartz fragments with trace of pyrite.

1/ Semiquantitative spectrographic analysis gave 30 ppm Mo.
Atomic absorption analysis gave 70 ppm Zn.



Base from U.S. Geological Survey 1:63,360 Sumdum C-5 1951

Figure 48.- Chuck River lodes and north shore of Windham Bay, prospect and sample locations

Figure 48.--Chuck River lode and north shore of Windham Bay, sample locations.

North shore Windham Bay

Samples were taken of slightly altered and pyrite-bearing schists along the north shore of Windham Bay (fig. 48). One sample contained 280 ppm copper and 55 ppm lead (table 19).

A prominent iron-stained cliff consisting of altered diorite is located at an elevation of 500 feet above the north side of Windham Bay about 5,000 feet east of the mouth of Taylor Creek. The Walhalla claim was staked over this red-stained cliff in 1930. A 28-foot-long spaced chip sample was taken along its base. The sample (4S155) location is shown in figure 48. The only metals of significance in the sample were 30 ppm molybdenum and 0.7 ppm silver.

Windham Bay ultramafic body

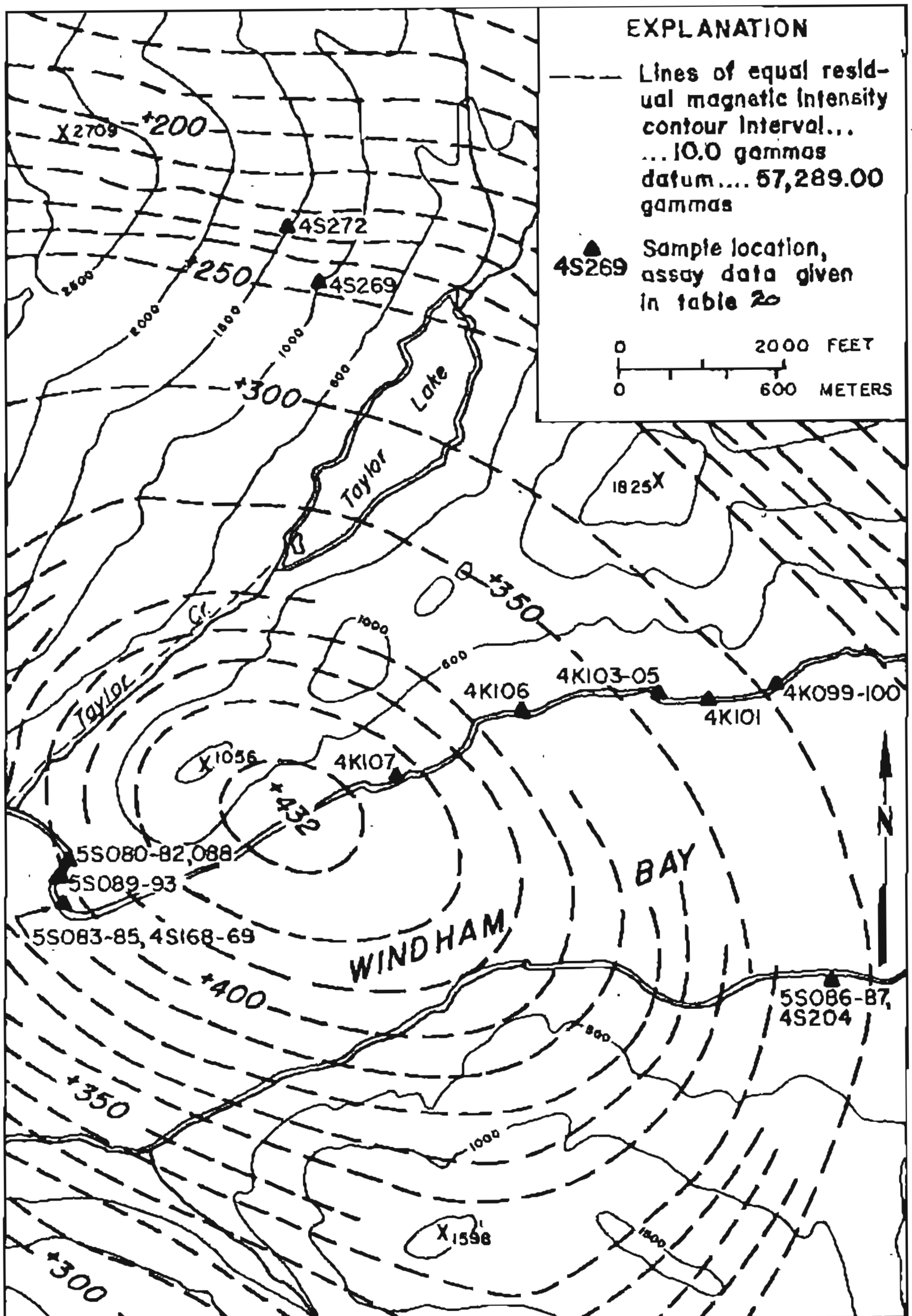
An aeromagnetic survey revealed a magnetic high with a maximum intensity of 432 gammas above a 57,289 gamma datum centered just north of the north shore of Windham Bay and south of Taylor Lake. The area is covered with heavy timber and brush with few rock exposures except for the intertidal zone or streambeds. Investigation revealed magnetite-rich hornblende pyroxenite west of Taylor Lake, on the north and south shores of Windham Bay, and in a 1,000-foot pass between the lake and bay. These rocks are clearly the source of the magnetic high; however, exposures are too poor to establish clearly the outline of the body.

Channel and chip samples were taken of the ultramafic exposures. Figure 49 is a map showing sample locations and the results of the

Figure 49 near here.

aeromagnetic survey. The lines of equal magnetic intensity shown have not been corrected for topographic effect. In addition to the standard analysis, selected samples were crushed to 100 mesh and the magnetic portion was separated in a Davis tube. Thus each sample was divided into two parts: a heads (original sample) concentrate (the magnetic portion), and a tails portion. Some of these samples were analyzed for silicon, iron oxide, sulfur, phosphorous, and vanadium. Iron and titanium were determined by X-ray fluorescence or chemically and the silicon by activation analysis. The results of the analysis are shown in table 20.

TABLE 20 NEAR HERE.



Base from U. S. Geological Survey 1951 and geoMetrics 1973 Residual Magnetic Intensity Map 1: 63,360 Sumdum C-5

Figure 49. -- Windham Bay ultramafic area, sample locations and aeromagnetic anomaly

Figure 49.--Windham Bay ultramafic area, sample locations and aeromagnetic anomaly.

Table 20.--Assay data, Windham Bay ultramafic area.

Sample	X-Ray Flouresence percent		Activation Analysis percent	Davis Tube Seperation percent	Atomic Absorption ppm	Semiquantitative Spectrographic Analysis			Description
						ppm	percent		
	Fe	Ti	SiO_2	-100 mesh	Cu	Ni	Cr	Fe	
				North shore of Windham Bay - continued					
4S168	16.8	1.23	42.7	-	220	50	100	15	
4S168	72.0	.38	1.9	9.4	-	-	-	-	
4S168	11.2	1.33	45.3	-	-	-	-	-	
4S169	17.8	1.37	41.3	-	300	50	100	15	
4S169	72.4	.46	2.0	8.2	-	-	-	-	
4S169	12.3	1.25	43.7	-	-	-	-	-	
5S080	-	-	-	-	160	70	300	15	Pyroxenite containing magnetite altered to amphibolite in places with occasional pods pematitic biotite amphibolite.
5S081	-	-	-	7.9	300	50	150	15	
5S082	-	-	-	8.2	200	70	100	15	
5S083	-	-	-	-	85	50	100	15	
5S084	-	-	-	-	60	20	50	15	
5S085	-	-	-	-	7	20	50	15	
5S088	-	-	-	11.3	320	70	150	20	
5S089	-	-	-	7.4	190	70	150	15	
5S090	-	-	-	-	80	50	100	15	
5S091	-	-	-	-	80	30	100	10	
5S092	-	-	-	-	150	70	150	15	
5S093	-	-	-	-	85	50	100	15	
Heads	-	2.0	-	-	-	-	-	-	
Mag.	-	3.3	-	5.9	-	-	-	-	
Tails	-	1.9	-	-	-	-	-	-	
4K099	-	-	-	-	80	50	300	7	Boulder fan of dark coarse-grained hornblendite.
4K100	-	-	-	-	65	70	200	7	do.
4K101	-	-	-	-	45	30	500	7	Very coarse-grained hornblende with biotite crystals.
4K103	-	-	-	-	680	100	150	15	Pyritic portions of hornblende-biotite rocks.
4K104	-	-	-	-	250	70	300	7	Hornblende-biotite rocks.
4K105	-	-	-	-	15	20	300	7	Fine-grained micaceous and highly-silicfied phase of biotite rocks.
4K106	-	-	-	-	270	50	150	15	High-grade selection of sulfides in hornblende-biotite rocks.
4K107	-	-	-	-	170	30	70	20	Random rubble selection along 100 ft. of beach.
				South shore of Windham Bay - continued					
4S204	7.52	0.34	48.3	-	L	70	1500	7	Pyroxenite containing magnetite altered to amphibolite in places with occasional pods of pematitic biotite amphibolite.
4S204	45.5	.16	21.6	9.4	-	-	-	-	
4S204	3.71	.38	50.9	-	-	-	-	-	
5S086	-	-	-	4.9	5	100	2000	10	
5S087	-	-	-	1.9	L	100	2000	7	
				West of Taylor Lake - continued					
4S269	15.5	1.22	40.7	-	-	-	-	-	Hornblende pyroxenite with magnetite.
4S269	75.1	.62	2.8	8.2	-	-	-	-	do.
4S269	10.1	1.21	44.7	-	-	-	-	-	do
4S272	-	-	-	-	30	20	20	7	do.

Table 20.--Assay data, Windham Bay ultramafic area, continued.

Sample	Type	Length Ft.	Length (m.)	Chemical Analysis percent Fe	Fe++	S	P	V
			North shore of Windham Bay					
4S168 - heads	Channel	10.0	(3.0)	-	9.4	-	-	-
4S168 - magnetic concentrate	do.	10.0	(3.0)	-	41.4	8.55	0.002	0.48
4S168 - tails	do.	10.0	(3.0)	-	7.6	-	-	-
4S169 - heads	do.	10.0	(3.0)	-	10.0	-	-	-
4S169 - magnetic concentrate	do.	10.0	(3.0)	-	43.3	7.65	.003	.47
4S169 - tails	do.	10.0	(3.0)	-	7.5	-	-	-
5S080	Spaced chip, 1-ft. interval	25	(7.6)	-	-	-	-	-
5S081	do.	25	(7.6)	-	-	-	-	-
5S082	do.	25	(7.6)	-	-	-	-	-
5S083	do.	32	(9.8)	-	-	-	-	-
5S084	do.	32	(9.8)	-	-	-	-	-
5S085	do.	31	(9.4)	-	-	-	-	-
5S088	do.	25	(7.6)	-	-	-	-	-
5S089	do.	25	(7.6)	-	-	-	-	-
5S090	do.	25	(7.6)	-	-	-	-	-
5S091	do.	25	(7.6)	-	-	-	-	-
5S092	do.	25	(7.6)	-	-	-	-	-
5S093	do.	25	(7.6)	-	-	-	-	-
Heads	Composite of 5S080-085 & 088-093	320	(97.5)	13.2	-	-	-	-
Magnetic concentrate	do.	320	(97.5)	53.3	-	-	-	-
Tails	do.	320	(97.5)	10.6	-	-	-	-
4K099	Spaced chip, 1-ft. interval	86	(26.2)	-	-	-	-	-
4K100	do.	43	(13.1)	-	-	-	-	-
4K101	Chip	26	(7.9)	-	-	-	-	-
4K103	Selected grab	-	-	-	-	-	-	-
4K104	Chip	19	(5.8)	-	-	-	-	-
4K105	do.	8	(2.4)	-	-	-	-	-
4K106	Selected grab	-	-	-	-	-	-	-
4K107	Random grab	-	-	-	-	-	-	-
			South shore of Windham Bay					
4S204 - heads	Chip	10.0	(3.0)	-	3.6	-	-	-
4S204 - magnetic concentrate	do.	10.0	(3.0)	-	14.5	0.02	0.004	0.06
4S204 - tails	do.	10.0	(3.0)	-	2.9	-	-	-
5S086	Spaced chip, 1-ft. interval	17	(5.2)	-	-	-	-	-
5S087	do.	17	(5.2)	-	-	-	-	-
			West of Taylor Lake					
4S269 - heads	Spaced chip, 1-ft. interval	13	(3.9)	15.5	8.1	-	-	-
4S269 - magnetic concentrate	do.	-	-	75.1	25.1	1.46	0.001	0.040
4S269 - tails	do.	-	-	10.1	6.3	-	-	-
4S272	Spaced chip, 0.5-ft. interval	12	(3.7)	-	-	-	-	-

In general, the results of analysis of the larger measured samples indicate that the iron content and recovery of magnetic iron are far below that of the Snettisham iron deposit, located 30 miles north. The iron content of the 320-foot spaced chip sample taken on the north side of Windham Bay was 13.2 percent; a concentrate can be produced by magnetic recovery that comprises about 5.9 percent of the original sample with a grade of 53.3 percent iron. At Snettisham, a composite sample of drill holes averaged 18.9 percent iron with a 19 percent magnetic recovery of the original sample with a grade of 64 percent iron (Thorne, 1956). This lower magnetite content probably largely accounts for the much lower aeromagnetic intensity of the anomaly over the Windham Bay body than over the Snettisham body (432 gammas versus 2154 gammas). Analyses do not indicate significant copper or nickel.

In general, while the Windham Bay ultramafic may be similar in some respects to other ultramafic bodies in Southeast Alaska that are considered potential iron or copper nickel mines, samples taken from this body during our study lack significant iron, copper or nickel.

Holkham Bay prospect

The Holkham Bay prospect is at the 2,000-foot elevation on the southwest shore of Endicott Arm across the Arm from Fords Terror and due east of Windham Bay (pl. 3). An overgrown foot trail leads to the property from the cove on the Sulphide prospect 2 miles to the northwest. Gold-bearing quartz veins were discovered about 1900 and have been periodically restaked, most recently in 1956 as four claims of the Gold Seal-Gold Coin group. A Gibson mill was formerly present near the upper workings at the prospect. Local residents indicate this was during the 1930's.

A 1- to 2-foot-thick quartz vein has been explored by 240 feet of underground workings consisting of a 170-foot drift with three stope raises (figs. 50 and 51). Surface pits indicate the vein is at least

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Figures 50 and 51 near here.

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400 feet long. A second vein more than 6 feet thick is well exposed for several hundred feet along strike and has been explored with several shallow shafts and open cuts. A 65-foot crosscut driven below the hill toward this vein falls several hundred feet short of intersecting the projection of the vein. Figure 50 shows relationships of these features. Wall rocks in the upper workings are graphitic schists with traces of pyrrhotite of the phyllite and slate map unit. They are considerably sheared and in places interfinger with the quartz vein. Host rocks of the thick quartz vein to the east appear more siliceous.

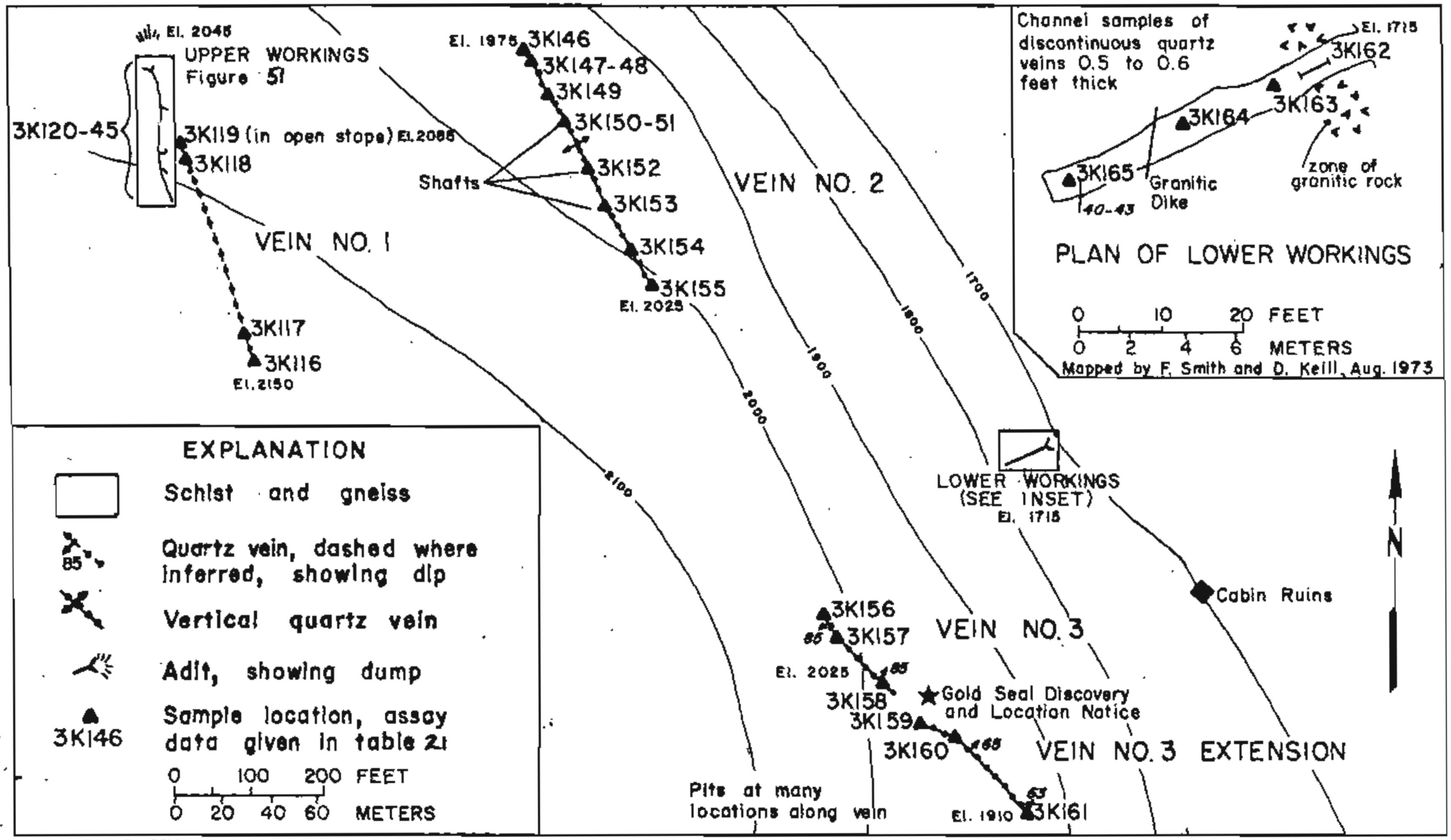
Brief references to the property in early literature (Spencer, 1904, 1906; Brooks and others, 1908, 1909) indicate that much of the development described above and seen during this study had been done by 1909. A tramline swath reportedly cut in 1908 is still visible, but no tramline was constructed.

Fifty channel samples were cut normal to the quartz veins in surface and underground exposures. Twenty-six of these were cut in the upper underground workings where the better gold values were found (table 21). With the exception of a single assay of 4.89 ounces gold

TABLE 21 NEAR HERE.

per ton across a 0.9-foot vein, values in the drift ranged from nil to 0.61 ounces gold per ton and averaged 0.094 ounces gold per ton. Average vein width is about 1-1/2 feet. About half of the samples contained a trace to a few ppm silver but no other metals of significance although an occasional surface sample gave slightly anomalous values in zinc or lead.

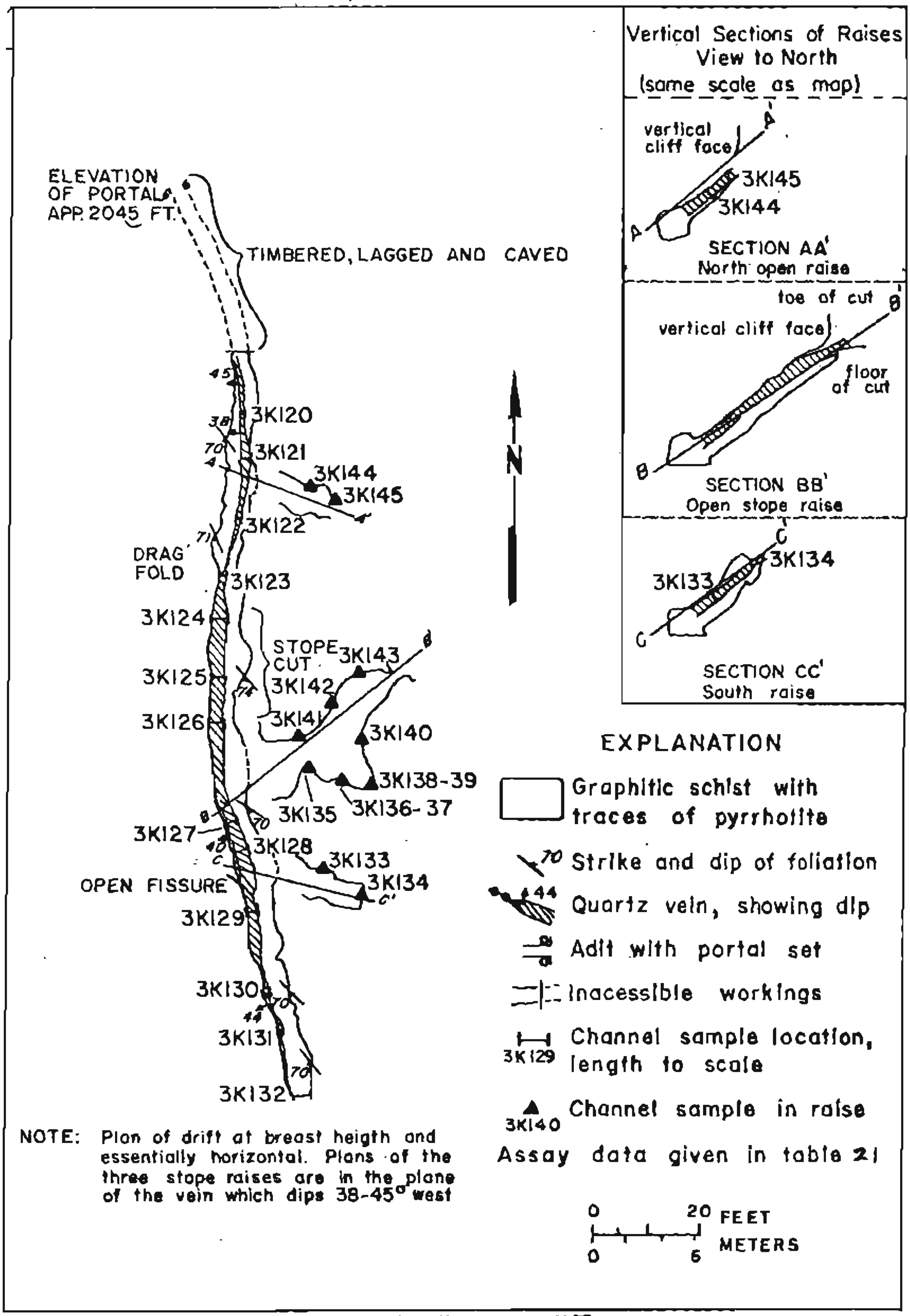
Based on the sample results, the mined-out high-grade ore shoot probably contained 20-50 ounces of gold. Further development of the mine was curtailed by lower gold values and the vein pinched out in the drift.



Mapped by T. Pittman and A. Kimball, August 1973

Figure 50.-- Holkham Bay prospect, workings and sample locations

Figure 50.--Holkham Bay prospect, workings and sample locations.



Mapped by T. L. Pittman and A. Kimball, August 1973

Figure 51. -- Holkham Bay prospect, upper workings sample locations

Figure 51.--Holkham Bay upper workings, sample locations.

Table 21.--Assay data, Holkham Bay prospect.

Sample	Type	Length Ft.	Length (m)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption ppm Au	Atomic Absorption ppm Pb	Fire Assay ppm Au	Fire Assay ppm Ag	Description
				Vein #1, surface exposure					
3K116	Channel	1.5	(0.5)	N	N	L	-	-	Iron-stained quartz vein.
3K117	do.	1.6	(.5)	N	0.05	N	-	-	Slightly iron-stained quartz vein.
3K118	do.	1.4	(.4)	N	2.0	5	-	-	Iron-stained quartz vein.
3K119	do.	3.1	(.9)	N	6.2	L	8.6	7.5	do.
				Vein #1, underground exposure (upper workings)					
3K120	Channel	0.6	(0.2)	0.5	13.0	20	1.4	2.7	Quartz vein.
3K121	do.	1.5	(.5)	.5	21.0	5	11.7	1.4	Iron-stained quartz vein.
3K122	do.	.5	(.2)	N	.50	L	-	-	Quartz vein.
3K123	do.	.8	(.2)	.5	15.0	15	N	.3	do.
3K124	do.	1.6	(.5)	N	.55	10	-	-	do.
3K125	do.	1.8	(.5)	N	3.0	15	-	-	do.
3K126	do.	1.9	(.6)	2	8.0	15	19.9	5.1	do.
3K127	do.	1.4	(.4)	1	.30	30	-	-	do.
3K128	do.	1.8	(.5)	N	.10	10	-	-	do.
3K129	do.	1.4	(.4)	N	.05	5	-	-	do.
3K130	do.	.7	(.2)	N	1.4	30	-	-	do.
3K131	do.	.5	(.2)	.5	L	25	-	-	do.
3K132	do.	2.7	(.8)	.5	.05	25	-	-	Sheared zone in phyllite and schist with thin quartz vein.
3K133	do.	1.1	(.3)	1.5	.10	45	-	-	Schist with 0.1-ft band of quartz.
3K134	do.	.4	(.1)	N	.60	5	-	-	Quartz vein.
3K135	do.	1.9	(.6)	N	N	L	N	L	do.
3K136	do.	2.0	(.6)	1	3.8	20	N	1.0	Top 2.0 ft of 4.7-ft thick quartz vein.
3K137	do.	2.7	(.8)	N	.45	L	-	-	Bottom 2.7 ft of 4.7-ft thick quartz vein.
3K138	Channel	2.1	(.6)	1	L	25	-	-	Top 2.1 ft of 4.3-ft thick quartz vein.
3K139	do.	2.2	(.7)	N	N	L	-	-	Bottom 2.2 ft of 4.3 ft thick quartz vein.
3K140	do.	3.4	(1.0)	N	3.0	10	0.7	1.7	Quartz with thin schist partings, none more than 0.1 ft thick.
3K141	do.	.9	(.3)	7	330	20	167.6	15.4	Quartz vein.
3K142	do.	1.0	(.3)	L	.50	L	0.3	2.7	do.
3K143	do.	1.8	(.5)	N	5.3	L	-	-	do.
3K144	do.	2.2	(.7)	.5	4.0	10	2.7	L	do.
3K145	do.	2.0	(.6)	L	5.3	L	8.2	0.3	Sheared zone with 1.8-ft thick quartz vein.

Table 21.--Assay data, Holkham Bay prospect, continued.

Sample	Type	Length Ft.	Length (m)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption ppm Au	Atomic Absorption ppm Pb	Fire Assay ppm Au	Fire Assay ppm Ag	Description
				Vein #2, surface exposure					
3K146	Channel	7.0	(2.1)	0.5	0.05	25	-	-	Quartz vein
3K147	do.	12.0	(3.7)	N	L	5	-	-	Quartz vein with schistose bands.
3K148	do.	12.0	(3.7)	1	2.0	110	-	-	do.
3K149	do.	10.0	(3.0)	3	.60	50	-	-	Quartz and schist, hanging wall of quartz vein.
3K150	do.	3.5	(1.1)	L	1.3	10	-	-	Pit in quartz vein.
3K151	do.	5.0	(1.5)	.5	1.0	30	-	-	do.
3K152	do.	5.0	(1.5)	.5	.50	40	-	-	Quartz and schist, hanging wall of quartz vein.
3K153	do.	6.7	(2.0)	1	.75	140	-	-	Quartz vein.
3K154	do.	6.2	(1.9)	2	1.2	40	-	-	do.
3K155	do.	3.6	(1.1)	N	N	N	-	-	do.
				Vein #3, surface exposure					
3K156	Channel	5.5	(1.7)	5	3.8	1100	8.9	28.1	Quartz vein with thin schistose bands.
3K157	do.	5.5	(1.7)	L	2.8	45	7.20	L	do.
3K158	do.	6.1	(1.9)	N	L	20	-	-	do.
				Vein #3 extension, surface exposure					
3K159	Channel	10.7	(3.3)	0.5	N	30	-	-	Quartz vein.
3K160	do.	9.0	(2.7)	N	0.20	L	-	-	do.
3K161	do.	6.8	(2.1)	.5	.25	35	-	-	Quartz vein, minor interfingering with schist.
				Lower adit					
3K162	Chip	5.0	(1.5)	L	N	5	-	-	Gneissic rocks.
3K163	Channel	.5	(.2)	0.7	0.05	85	-	-	Quartz vein.
3K164	do.	.5	(.2)	N	.75	10	-	-	0.1-ft thick quartz vein enclosed in schist.
3K165	do.	.6	(.2)	N	N	20	-	-	Quartz vein.

Spruce Creek placers

Placer gold was discovered near Windham Bay in 1869 (Spencer, 1906), probably on Spruce Creek although drainage is not specified. Another report indicates that sluice box remains were found on upper Spruce Creek by the 1869 prospectors.

Spruce Creek, which is about 3 miles long, crosses several slightly mineralized phyllitic schist belts which were prospected for lode gold. There appear to have been several small mining operations along this belt (fig. 26). Several placer basins were also identified and Spencer (1904 and 1906) noted that early attempts were made to mine two of these. A plant was installed in the first basin (nearest the creek mouth) in 1888 about 1/4 mile from tidewater. Mining was conducted about the same time in a second basin a mile upstream at an elevation of 750 feet. Placer claims covering both basins were patented before 1900. Concurrent other operations were also reported in smaller basins further upstream. There has been little placer mining for the past 50 years. Operations ceased in the mid-50's. Total placer production from Spruce Creek was probably small, however there are no production records. It is doubtful that the creek contains undiscovered placers of any importance.

Reconnaissance during the present study showed that early mining removed extensive gravels from the first (lowest) basin; however, no evidence could be found of mining in the second basin. Well above the two basins remnants of placer pipe, old cuts, cabin ruins, and one well-constructed but old dry-wall diversion with ditch were seen along upper Spruce Creek between an elevation of 1,600 and 2,500 feet. Shallow gravels and small potholes in or close to bedrock along parts of the upper creek would have been well suited for small-scale hand mining methods especially during low water periods.

During early mining about 10 acres of the first basin were sluiced by means of a bedrock tunnel several hundred feet long driven before 1890 through the greenstone barrier at the lower end of the basin and through which the creek now flows. The basin floor near the tunnel entrance is probably more than 80 feet below the original bedrock stream channel which crosses the barrier just south of the tunnel site. A second smaller tunnel 10 feet beneath the original stream channel is almost completely obscured and probably predates the lower tunnel.

The lower basin is evidently of glacial origin. Blue clay and silt layers dip gently into the basin and marine(?) fossils are present more than 20 feet below the original surface of the basin. Poorly sorted gravel and cobble layers above the blue clay are suggestive of delta foreset beds that were probably deposited when post-glacial seas were higher than the barrier. These deposits, now seen along the margins of the basin, are truncated and capped by nearly horizontal, moderately well sorted gravels slightly higher than the original stream channel and probably represent the original topography over the basin. Gold was readily panned from this layer but little could be panned elsewhere except for a few colors just above the blue clay. Little could be panned from the sloping, poorly sorted gravel layers, from bars or from behind stream boulders where concentration might be expected.

Spencer (1904) noted that the possibility of making wages with shovel and pan along the edges of the deposits had been demonstrated, but that the larger operations failed. From this and from our observations it appears that some pay streaks were found in the original stream channel but probably did not persist in the less sorted basin fill below the barrier level.

Sixteen panned concentrates collected from a range of types of deposition within the lower basin were fire assayed for gold (fig. 52 and table 22). A few colors could usually be panned at these sites.

Figure 52 near here.

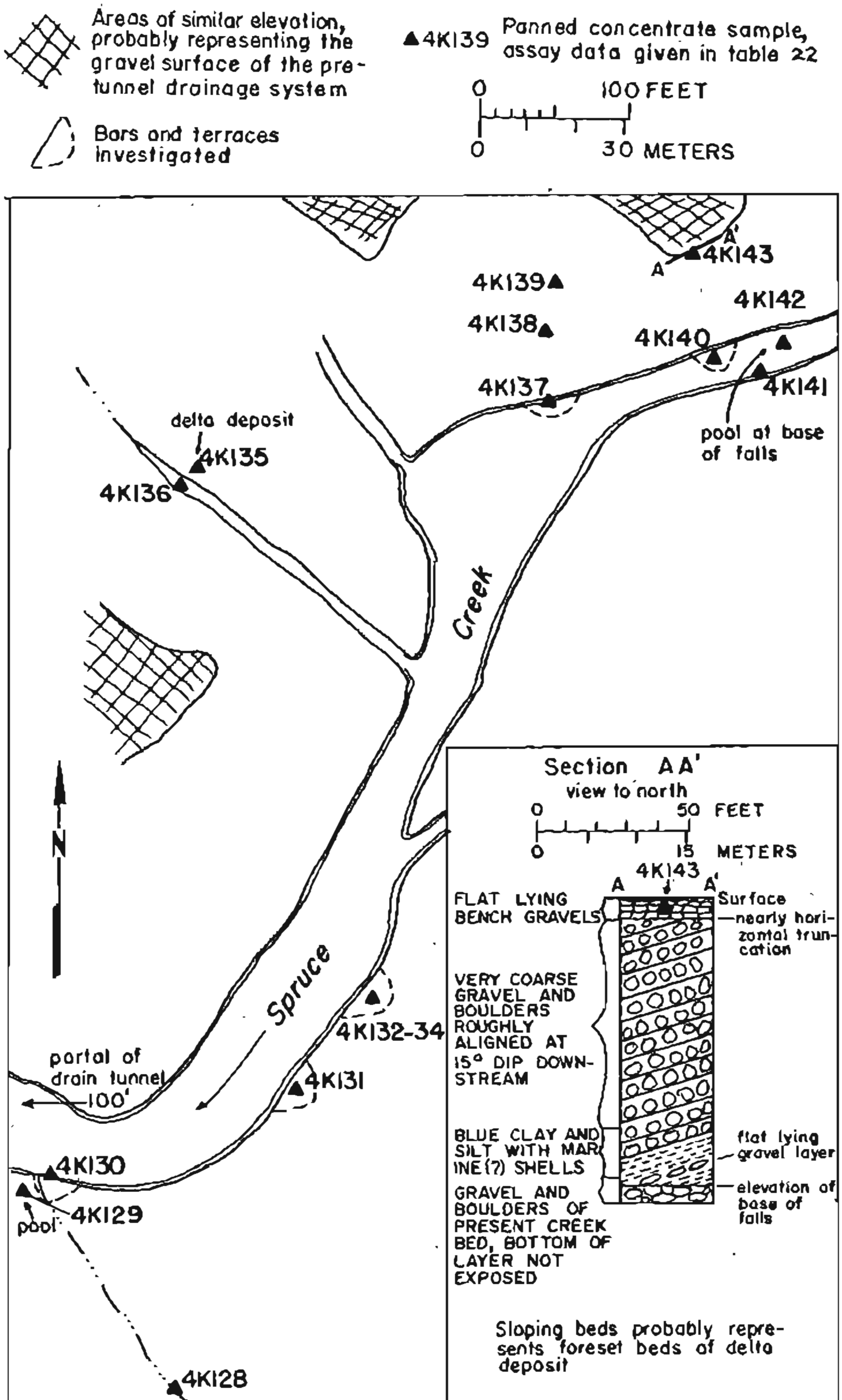
TABLE 22 NEAR HERE.

Analyses run on the minus and plus 80 mesh fractions show that the percent of gold in the sample does not systematically correlate with one or the other of the fractions. Milligrams of gold in the total sample was converted to ounces of gold per cubic yard of material in place. One sample (4K143) from a moderately well sorted, nearly horizontal gravel 15 feet higher than the barrier assayed 0.017 ounce per cubic yard. All other samples were from lower in the basin; seven assayed between 0.0026 and 0.001 ounce gold per cubic yard while the gold content of the remaining eight samples was below the limit of quantitative determination. The samples taken in the basin are of selected material and do not systematically appraise the ground except in the sense that most came from localities where above average values might be expected. Sample results indicate that this is not an economically minable deposit.

Table 22.--Placer workings in the first basin of Spruce Creek.

Sample	oz/cu yd 1/
4K128	N
4K129	N
4K130	N
4K131	0.0001
4K132	.0022
4K133	.0016
4K134	.0007
4K135	N
4K136	N
4K137	.0026
4K138	.0002
4K139	.0001
4K140	N
4K141	N
4K142	N
4K143	.0171

1/ Calculated from mg total gold by fire assay analysis (14 in. pan at 270 pans/cu yd)



Mapped by A. Kimball and M. A. Parke, July 1974

Figure 52.- Placer workings in the first basin of Spruce Creek, sample locations

Figure 52.—Placer workings in the first basin of Spruce Creek, sample locations.

Chuck River placers

The Chuck (Shuck) River and two of its tributaries, Sylvia (Sylva) and Slate Creeks entering the river between 1 and 4 miles above the mouth, are reported by Spencer (1906) to have been the scene of some indeterminant amount of placer activity near the turn of the century. The Chuck River proper which is about 15 miles long and flows into Windham Bay from the south presents several basins that might have some potential for placer deposition. About 25 placer claims were located along it near the turn of the century. According to mining records most of these claims were grouped crudely 3, 5 and 10 miles from the mouth. Spencer (1906) discussed a horseshoe bend about 8 miles above the mouth where a 300-foot diversion tunnel reportedly was driven in 1903 leaving gravels accessible for mining. Whether they were mined is uncertain. A long-time nearby resident of the Windham Bay vicinity indicated that this site was unlikely to have been very productive because of low gold values and because of the unfavorable physical conditions for placer mining. There is no mention of placer production from this river in Spencer's work or in the Bureau of Mines records.

Sylvia Creek is about 4 miles long and flows into the Chuck River from the east. About 20 placer claims were located along it near the turn of the century. Slate Creek, also about 4 miles long, flows into the Chuck River from the west. Spencer (1906) reports that a hydraulic line and sluice boxes were set up around the turn of the century on a group of three claims called the Lost Rocker group that were located in a basin about 1/2 mile from the Chuck River. There is no record of production from either Sylvia or Slate creeks although some probably did occur.

Placer Lakes

Placer Lakes comprise two small glacial lakes situated in a rugged basin 6 miles southeast of Windham Bay (loc. no. M-10, pl. 2) at an elevation of about 3,300 feet. Records show that the placer claims were located near the lakes' outlet in 1898.

A proposal to drain the lakes by tunnel during the 1930's and mine placer gold from the lake basin sediments is considered by local residents to have been a promotional scheme. At the time a 7-mile tractor trail, now largely obliterated, was constructed from the mouth of Sylvia Creek on Chuck River to the lake shore.

The lakes were frozen and snow covered the basin when visited in late July 1975. A large composite grab sample of stream sediments was obtained near the mouth of the largest stream entering the lake. This sample assayed 0.005 ounces gold per cubic yard (using 1.5 tons per cubic yard conversion, volume was not measured).

There is no indication either in the records or on the ground that any mining occurred.

Sanford Cove to Taylor Lake

The Sumdum Chief gold mine, the Croney and Taylor Lake prospects are located between Sanford Cove and Taylor Lake. The geology of the two areas is similar: gray fissile graphitic limestone or phyllite cut by numerous small quartz stringers and veins which generally follow the foliation. Occasionally large quartz veins in excess of 1 foot in thickness crosscut foliation. Some of these large veins contain gold, similar to the mineralization of the Spruce Creek lodes in the Windham Bay area. The Sumdum Chief gold mine, Croney property and the Taylor Lake area were investigated. The Sumdum Chief gold mine operated from 1895 to 1904 and was the only mine in the Tracy Arm-Fords Terror area with significant production.

Sumdum Chief gold

The Sumdum Chief gold mine, made up of two gold veins known as the Sumdum Chief and the Bald Eagle, is located about 2 miles south of Sanford Cove on Bald Eagle Creek and consists of five patented claims. This mine accounts for nearly all production from the study area. Figure 53

Figure 53 near here.

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shows the claim locations. According to Spencer (1906), two lodes were mined from a 3,500-foot haulage drift. The Bald Eagle lode was

intersected at a depth of 500 feet where it was 20 feet wide and carried 0.5 to 0.10 ounces gold per ton. On the surface, this lode was two feet wide and assayed 0.48 to 0.73 ounces gold per ton. The Sumdum Chief lode was intersected at a depth of 1,200 feet where it was only a narrow vein filling. On the surface, this lode was three feet wide. Between 1895 and 1903, approximately 24,000 ounces of gold and probably the same amount of silver were recovered from these veins (Becker, 1897, p. 76). The average grade of ore was reported at approximately 0.39 ounces gold per ton.

According to Roppel (1971), a 1,600-foot raise was driven from the end of the 3,500-foot haulage drift. The first part of the raise intersected ore, then only barren rock. By 1903, both ore bodies were stoped out and, when a diamond drilling program failed to reveal another ore body, the mining equipment was removed. Mining activity never revived in the area except for a brief flurry of activity in 1907 when an attempt was made to re-open the adit to mine other claims in the area (Roppel, 1971, p. 50).

Investigation of the Sumdum gold property revealed the site of the former mill on Robbins Creek at an elevation of 500 feet. A mile of corduroy road and a surface tram goes from Sanford Cove to the mill. An aerial tramway goes from the mill to the caved portal of the Sumdum Chief gold mine main haulage way. All are nearly obliterated. What is probably the Sumdum Chief vein and an opening to a stope were found at an elevation of 1,600 feet. The Bald Eagle vein, which reportedly would be exposed at an elevation of about 1,000 feet in Bald Eagle Creek, was not seen and was probably covered with slide snow or rubble. Figure 54 shows

Figure 54 near here.

the location of the patented claims that indicate the probable orientation of the Bald Eagle vein. This figure also shows the location of the samples, millsite, and main portal.

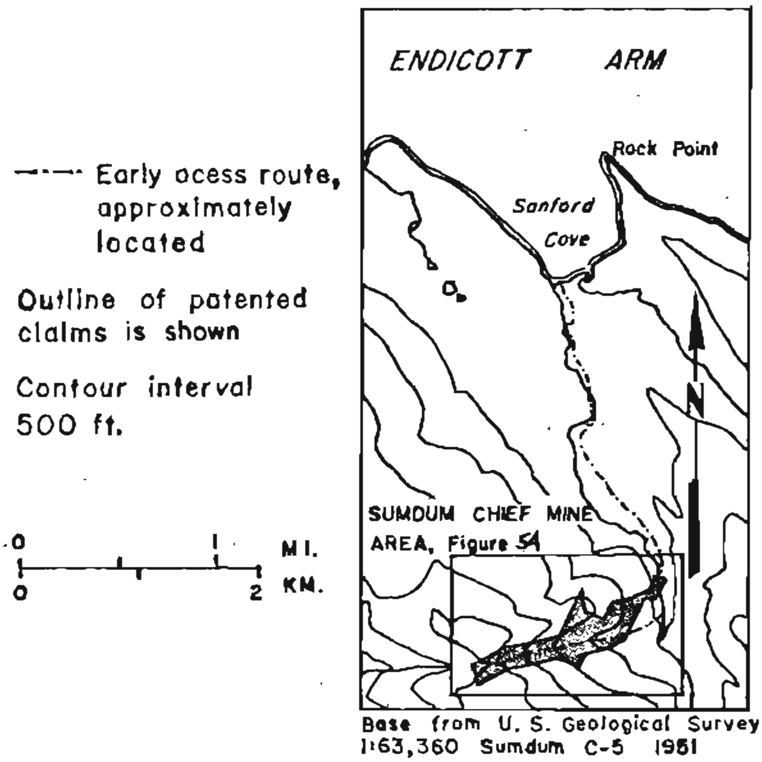
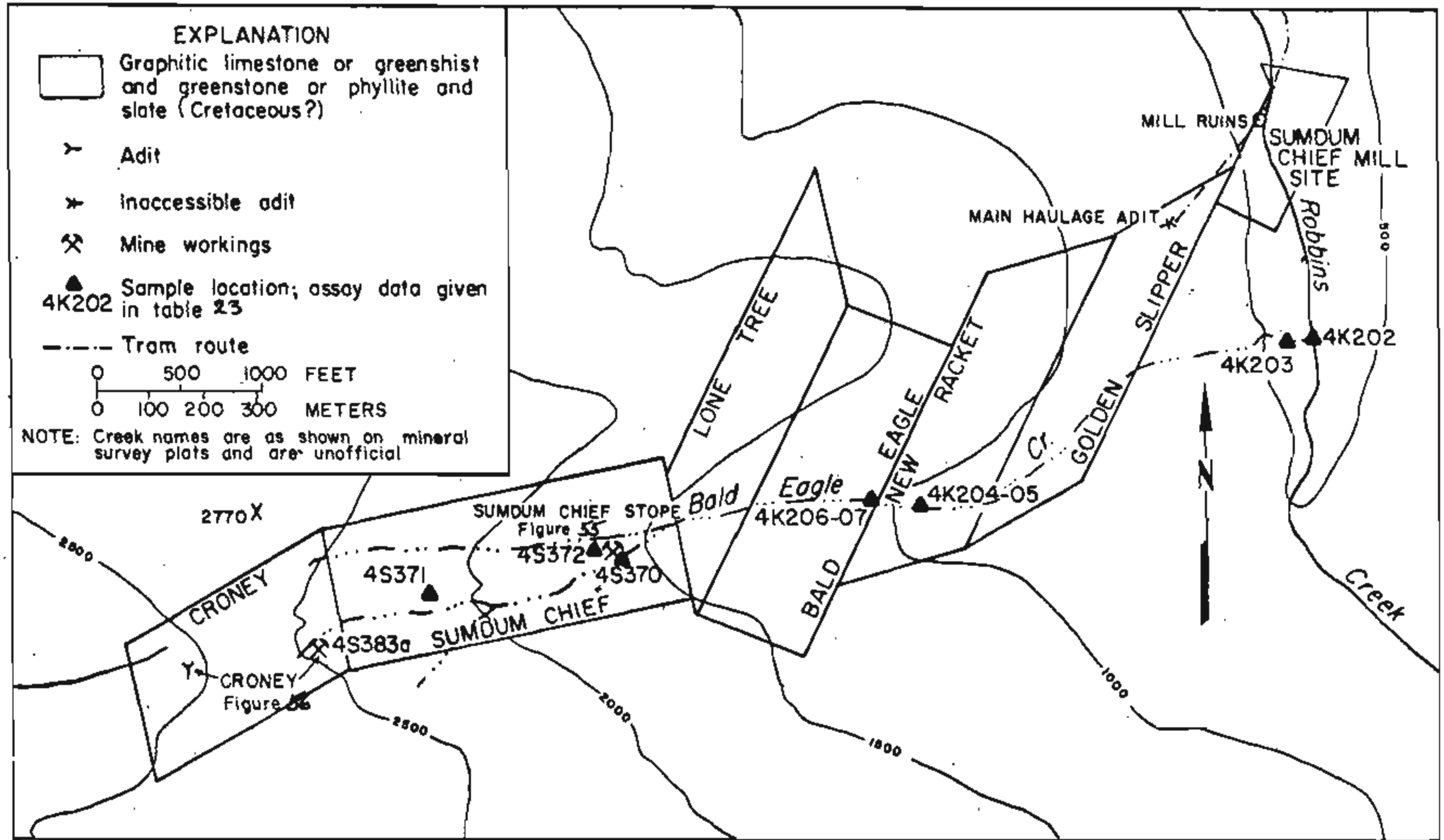


Figure 53.-- Index map of Sumdum Chief Mine area

Figure 53.--Index map of Sumdum Chief mine area.



Base from U. S. Geological Survey, 1:63,360 SUMDUM C-5 1951 and Mineral Survey plats no. 267A, 268A, 269-70, 424 and 525A-D, 1900

Figure 54.--Sumdum Chief mine area, sample locations, mine workings and patented claims

Figure 54.--Sumdum Chief mine area, sample locations, mine workings and patented claims.

The only accessible mine working is a stope on the Sumdum Chief vein. The opening is located on a precipitous, cleaver-shaped ridge 900 feet below a natural helipad in the 2,500-foot pass at the head of Bald Eagle Creek. Approach from below along Bald Eagle Creek would not be feasible except on avalanche snow early in the season. The rock and timber in the stope have deteriorated and it should be entered with care.

Samples were taken of stringer zones of quartz along the ridge near the stope on the surface. One sample was taken of the apparent Sumdum Chief vein on a shaft pillar in a stope. A rough sketch was made of this part of the stope (fig. 55). The attitude of the stope, N. 80° E.

Figure 55 near here.

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and inclined 84° to the north, is the same as the attitude of the 1-foot thick quartz vein. The fissile graphitic limestone host rocks of the phyllite and slate map unit strike N. 16 W. and dip 81° N. The vein was visible on the surface above the opening but was not accessible. This opening is probably at or near the highest level of workings. The quartz vein contained minor pyrite, sphalerite, galena, chalcopyrite and gold in disseminated fine grains. The gold appears to have been introduced with quartz and other sulfides and is intergranular with the quartz, often forming adjacent to sulfides.

The one sample to display significant values, a 1-foot long chip sample (4S365) across what is probably the upper part of the Sumdum Chief vein assayed 30.2 ppm (0.88 ounces per ton) silver, 26.1 ppm (0.76 ounces per ton) gold, 940 ppm copper, 1,900 ppm lead and 3,100 ppm zinc (table 23). Gross value of this sample in gold and silver for a 4-foot mining

TABLE 23 NEAR HERE.

width is about $26 per ton ($130 per ounce gold and $4.50 per ounce silver). A 0.4-foot channel sample (4S366) taken across the back of the stope entrance assayed at 2 ppm silver, 0.4 ppm gold, 180 ppm lead, and 660 ppm zinc. The remainder of the samples, including those of small quartz veins and silicified zones around the stope and the two taken on the ridge did not contain significant metal values.

Stream sediment samples were taken from Bald Eagle and Robbins Creek. Of four samples from Bald Eagle Creek, two contained 0.10 ppm and 0.40 ppm gold, and four contained 1 to 2 ppm silver. A stream sediment sample taken in Robbins Creek above Bald Eagle Creek contained 1 ppm silver.

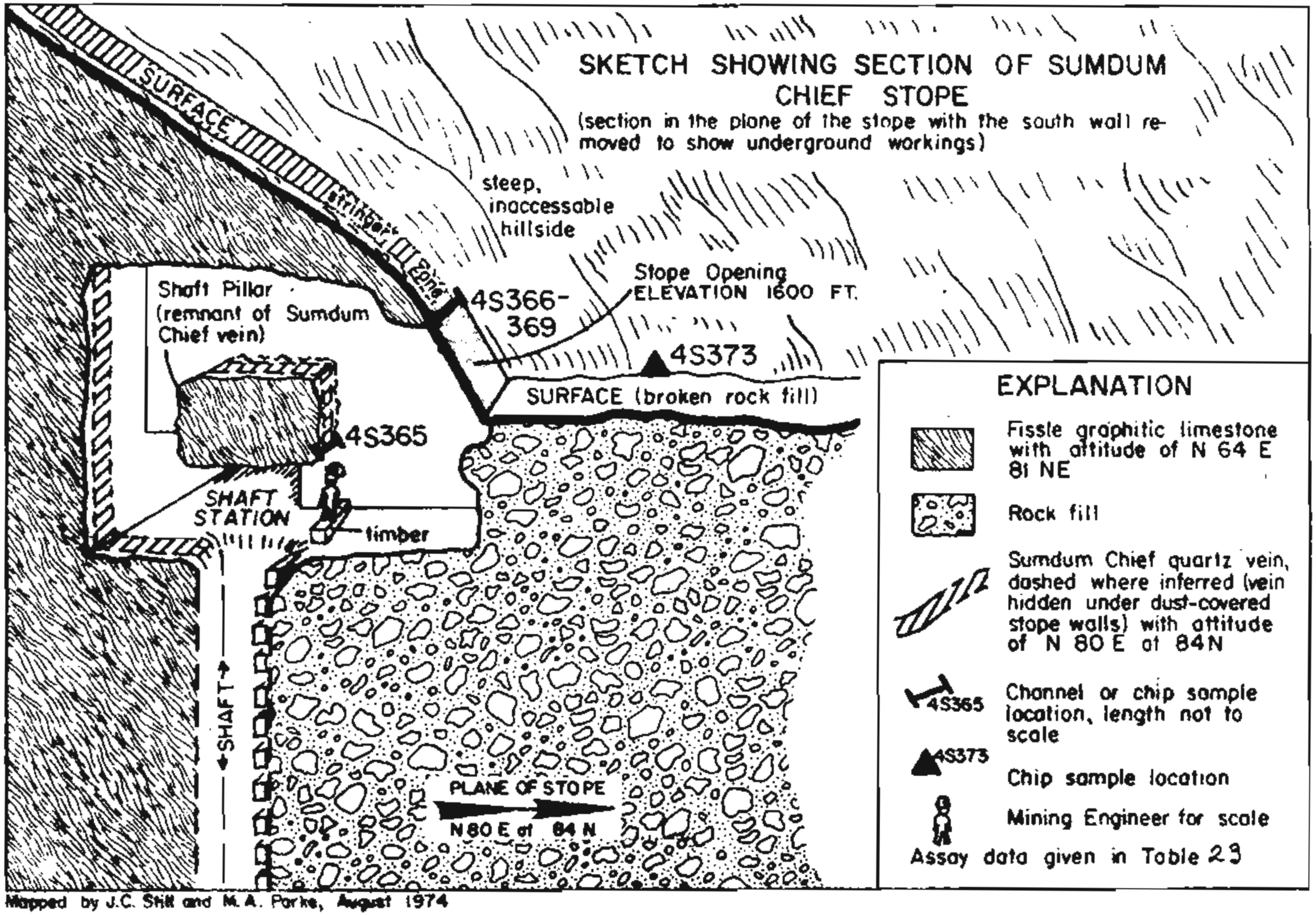

Figure 55.-Sumdum Chief stope, sample locations

Figure 55.--Sumdum Chief stope, sample locations.

Table 23.--Assay data, Sumdum Chief mine area.

Sample	Type	Length Ft.	Length (m)	Semiquantitative Spectrographic Analysis ppm Ag	Semiquantitative Spectrographic Analysis ppm Mo	Atomic Absorption ppm Au	Atomic Absorption ppm Pb	Atomic Absorption ppm Zn	Fire Assay ppm Au	Fire Assay ppm Ag	Description
						Sumdum Chief stope					
4S365 1/	Chip	1	(0.3)	50	50	30.0	1900	3100	26.1	30.2	Sumdum Chief quartz vein.
4S366	Channel	.4	(.1)	2	30	.40	180	660	.7	1.7	Quartz vein.
4S367	do.	1.6	(.5)	1	30	N	20	160	-	-	Graphitic limestone with a shaley parting.
4S368	do.	.5	(.2)	5	30	N	25	70	N	2.7	Quartz vein.
4S369	do.	1.5	(.5)	L	N	N	15	200	-	-	Graphitic limestone with a shaley parting with quartz stringers.
4S373	Chip	2.7	(.8)	N	N	N	15	30	-	-	Quartz stringers.
4S374	do.	.7	(.2)	N	N	N	5	15	-	-	Quartz vein.
						Cleaver-shaped ridge					
4S371	Channel	0.8	(0.2)	N	N	N	10	270	-	-	Silicified graphitic limestone with a shaley parting.
4S372	Chip	3.5	(1.1)	1.5	N	N	20	170	-	-	Folded quartz stringers in graphitic limestone with a shaley parting.
						Bald Eagle Creek and Robbins Creek					
4K202	Stream sediment	-	-	1	N	N	10	95	-	-	
4K203	do.	-	-	1.5	N	0.10	15	120	N	0.02	
4K204	do.	-	-	1	N	N	15	120	N	N	
4K205	Stream sediment, panned concentrate	-	-	1.5	N	.40	30	200	0.3	L	
4K206	Channel	0.4	(0.1)	L	N	N	L	230	-	-	Quartz vein, 0.4 ft. thick
4K207	Selected grab	-	-	2	N	.10	10	180	-	-	Schist float with pyrite and quartz.
4S370	Stream sediment	-	-	2	10	N	10	230	N	N	
						Croney workings-adit					
4S379	Chip	7.5	(2.3)	2	N	N	10	220	-	-	Quartz stringer zone in graphitic limestone with a shaley parting.
4S380	do.	10.0	(3.0)	1.5	N	N	10	130	-	-	Graphitic limestone with a shaley parting.
4S381	do.	10.0	(3.0)	3	N	N	10	200	N	0.7	do.
4S382	Channel	.2	(.1)	1	N	N	20	150	-	-	Quartz vein.
4S383	do.	1.1	(.3)	2	N	N	15	180	-	-	do.
						Croney workings-open cut					
4S383a	Chip	7.2	(2.2)	1	N	N	10	200	-	-	Quartz stringer zone in graphitic limestone with a shaley parting.

1/ Atomic absorption analysis gave 940 ppm Cu.

Spencer (1906, p. 44), Brooks (1905, p. 53) and Roppel (p. 50) indicate that by 1904 the Sumdum Chief and the Bald Eagle lodes were mined out, and that diamond drilling during the last stages of mining failed to reveal new ore. The Sumdum Chief lode was reported to be only a vein filling at the haulage drift level and the Bald Eagle lode, although 20 feet wide, contained only 0.05 to 0.10 ounces gold per ton. An attempt was made to mine the Bald Eagle lode below the haulage level by underhand stoping but it proved uneconomical (Spencer, 1906, p. 44). No mention is made in the literature about the horizontal extend of these two lodes. Bureau sampling in the area failed to reveal any new gold-silver veins. Neither mine maps, assays, nor details of the mine drilling program are available.

Another gold-silver quartz vein (Bluebird prospect) with a mineralogy and host rock similar to the Sumdum Chief is located 4 miles to the southeast. The area between the two is covered for the most part with dense brush and timber with few outcrops. Probably only a small portion of the intervening area has been thoroughly prospected so other similar gold-silver quartz veins may exist in the area.

Croney prospect

The Croney claim, which was patented in 1900, adjoins the Sumdum Chief on the west. Investigation revealed an open cut at a pass about 2,500 feet in elevation and a 27-foot adit on the west side of the pass. Figure 54 is a claim map and figure 56 shows details of the adit and

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Figure 56 near here.

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open cut. Table 23 gives the assay results. The samples were taken of stringer zones of quartz which follow the structure of the fissile graphitic limestone, which strikes N. 83° E. and dips 78° N. A very noticeable aspect of the structure of this prospect is the change in strike of the foliation from N. 64° W. at the Sumdum Chief lode to N. 83° E. at the Croney workings, a change of 33 degrees. The only metal of interest in the samples was silver, which ranged from 1 to 3 ppm in all the samples.

Taylor Lake area

Taylor Lake is located at the head of the Taylor Creek which flows into the north side of Windham Bay. The only trail in the area lies along the west side of Taylor Creek and connects Taylor Lake to Windham Bay.

The mining history of this area is vague. According to claims records, about 30 lode claims were staked in the area about 1900. The only mention of this area in literature is in Spencer (1906, p. 40, 42) in which a map imprecisely locates the Jack Pot gold prospect, and it is noted that little work has been done.

This area is covered with heavy timber and brush with few rock exposures. Almost all rock exposures are located in or near streambeds. Most claim locations were imprecisely described and no corner markers were found during the course of the investigation. Although claim locations could not be determined, the major rock exposures along the streams to the west, north east sides of Taylor Lake were investigated and sampled. During our investigation we found the remains of a corduroy road into Taylor Lake along the west side of Taylor Creek, and an open cut and flooded shaft on the Bluebird claim located about 1/8 mile from the northeast end of the lake. Figure 57 shows sample and

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Figure 57 near here.

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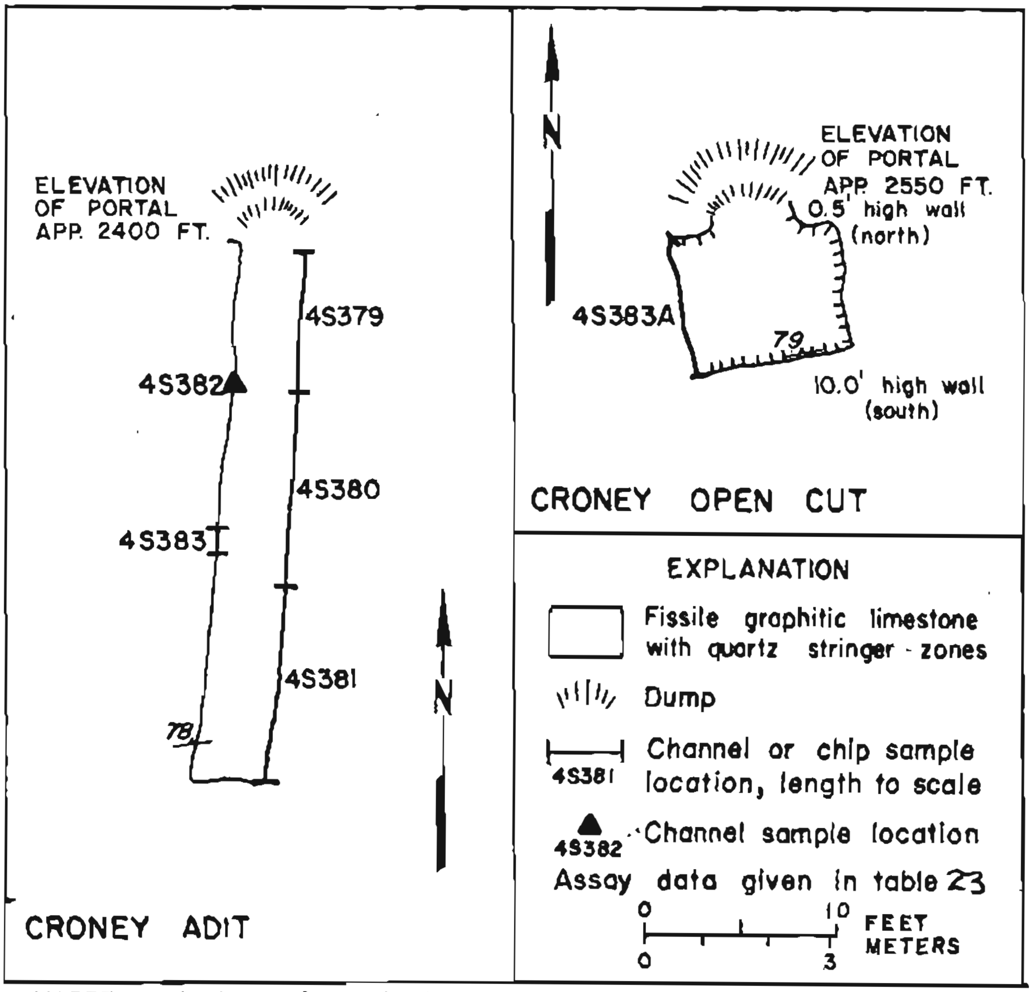
prospect locations.

The most significant sample values were found in a 1.5 to 1.6-foot thick cross-cutting quartz vein exposed in the open cut and in the stream on the Bluebird prospect. This vein contained significant gold and silver at the two exposures but was a factor of at least 20 from being of present economic interest. However, the mineralogy and host rock are similar to the Sumdum Chief mine located 4 miles to the northwest and further exploration of this vein and in the area may reveal higher values and more gold-silver quartz veins. The next most significant value was from a 2-foot to 3-foot thick quartz vein located at an elevation of 1,300 feet near a main stream flowing into the north end of Taylor Lake. A representative grab sample (4S138) taken from this vein assayed 15 ppm silver, 0.15 ppm gold, 1,300 ppm lead and 250 ppm zinc. The remainder of the samples did not contain significant values.



MAPPED BY M. A. PARKE, AUGUST 1974

Figure 56.-- Croney adit and open cut, sample locations

Figure 56.--Croney adit and open cut, sample locations.

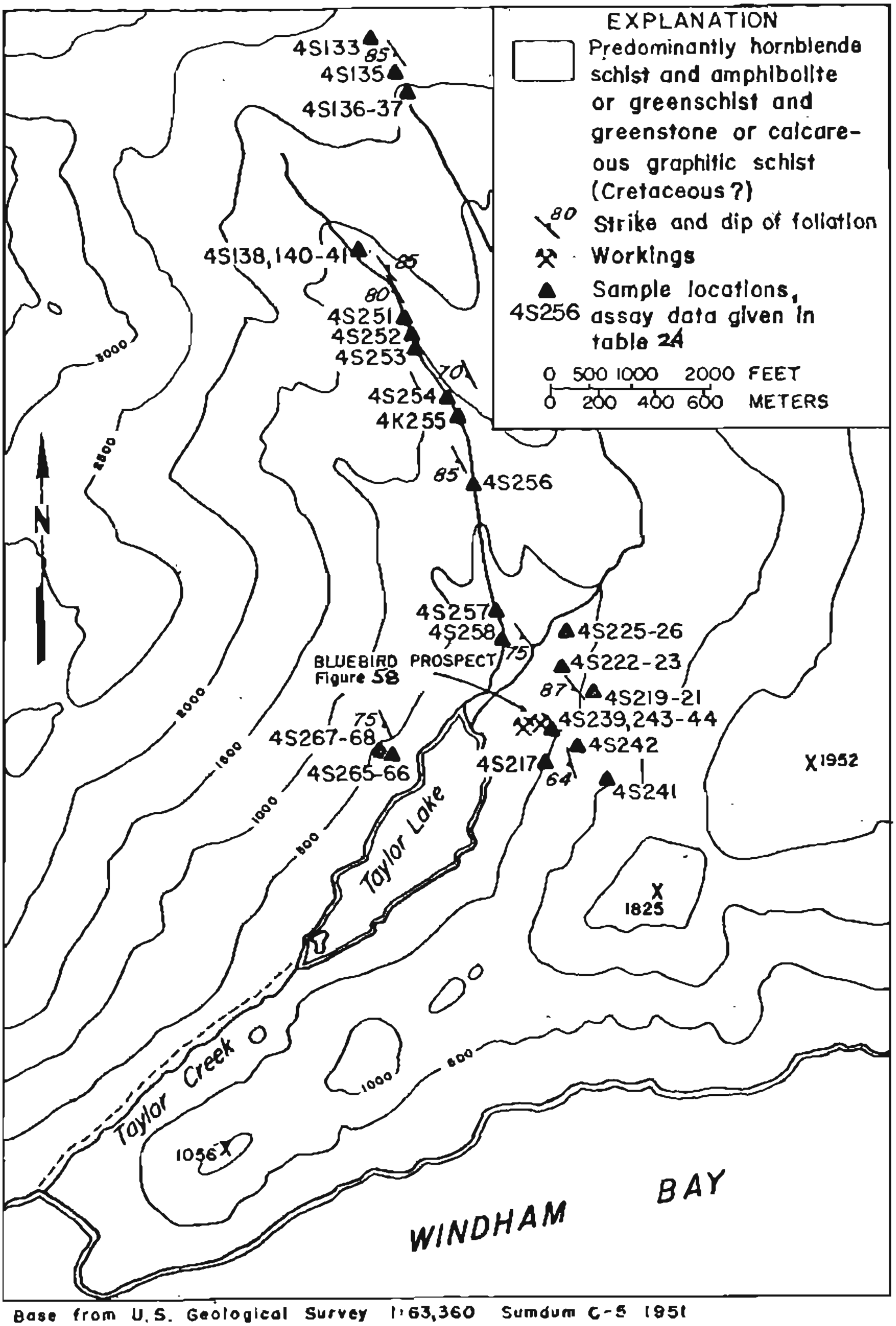


Figure 57.-- Taylor Lake area, prospect and sample locations

Figure 57.--Taylor Lake area, prospect and sample locations.

Bluebird prospect

The Bluebird claim was located in 1903 600 feet east of the north end of Taylor Lake, according to Juneau precinct mining records, on an approximately 2-foot thick quartz vein exposed in a small stream. There is no additional information on this claim although the nearby Jack Pot claim is briefly mentioned by Spencer (1906, p. 40).

There are two workings on the Bluebird claims: a 5-foot by 5-foot open cut on the south bank of a stream and a flooded shaft about 180 feet east-southeast of the open cut. Figure 58 shows the relationship

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Figure 58 near here.

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of the workings and the sample locations. The open cut exposes a 1.6-foot thick quartz vein that is exposed in the stream below it but not elsewhere. This quartz vein had an attitude of N. 40° W.-71° SW. while the calcareous graphitic schist country rock of the phyllite and slate map unit has an attitude of N. 22° W. at vertical. Abundant pyrite, sphalerite, chalcopyrite and galena are found in the hanging wall portion of the vein.

The 6-foot square shaft is flooded at a depth of 8 feet below the collar. The size of the dump indicates there are some 400 feet of underground workings. The only significant exposure of mineralized rock that occurs in the vicinity is the 1.6-foot thick quartz vein exposed at the open cut, and it is logical to assume the shaft was sunk to intersect this vein. The shaft would intersect the vein at a depth of about 125 feet and thus permit about 275 feet of drifting on the vein. The rocks on the dump consist of about 50 percent quartz with a texture and sulfide mineralogy similar to that of the open cut vein. A complete steam-powered hoisting unit was found at the shaft site.

The only samples to contain significant values were those taken of the quartz vein exposed in the stream and open cut. Table 24 gives the

TABLE 24 NEAR HERE.

analytical results. A 1.5-foot channel (4S235) cut across the vein exposed in the stream assayed 17.1 ppm silver, 2.0 ppm gold, 2,000 ppm lead and 1,300 ppm zinc, while a 0.3-foot channel (4S229) cut along the hanging wall portion of the vein exposed in the open cut assayed at 296.5 ppm silver, 2.1 ppm gold, 1,300 ppm copper, 3,300 ppm lead and 2,900 ppm zinc. The remaining 1.3-foot long footwall (4S230) portion of the open cut vein contained no significant metallic values. A selection of high sulfide quartz fragments taken across the shaft dump (4S233) assayed 3 ppm silver, gold was detected but below the measurable limit, 400 ppm copper, 840 ppm lead, and 2,800 ppm zinc. Similarity in geologic setting between the Sumdum Chief gold mine and Bluebird prospect indicates that the 4-mile area between them is favorable for vein type gold deposits.

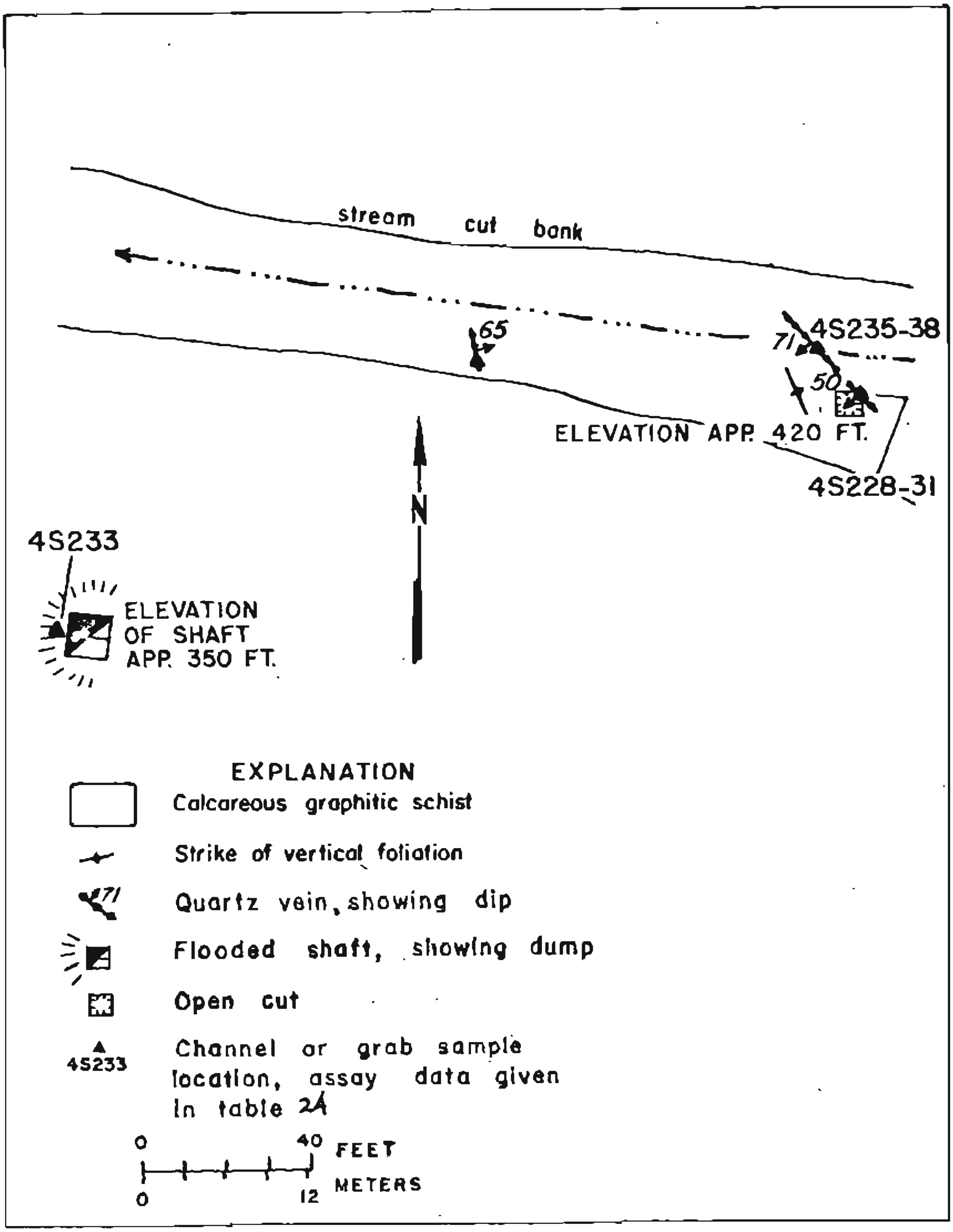

Figure 58.-- Bluebird prospect, sample locations

Figure 58.--Bluebird prospect, sample locations.

Table 24.--Assay results, Taylor Lake area.

Sample	Type	Length Ft.	Length (cm)	Semiquantitative Spectrographic Analysis ppm Ag	Mo	Atomic Absorption ppm Au	Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
						Bluebird prospect						
4S229	Channel	0.3	(9)	200	N	2.5	1300	3300	2900	2.1	296.5	Hanging wall of quartz vein with abundant sulfides.
4S230	do.	1.3	(40)	3	N	N	30	180	40	-	-	Footwall of same quartz vein.
4S228	do.	.5	(15)	3	N	.05	30	30	70	-	-	Carbonaceous schist, hanging wall of above vein.
4S231	do.	.5	(15)	1.5	N	N	10	420	75	-	-	Carbonaceous limey schist, footwall of above vein.
4S233	Selected grab	-	-	3	N	L	400	840	2800	-	-	Quartz vein with abundant sulfides.
4S234	Channel	.5	(15)	L	N	N	20	5	35	-	-	Quartz vein.
4S235	do.	1.5	(46)	15	20	2.0	350	2000	1300	L	17.1	do.
4S236	do.	.5	(15)	1.5	5	N	30	30	170	-	-	Carbonaceous limey schist.
4S237	do.	.5	(15)	1.5	7	N	20	30	120	-	-	Carbonaceous limey schist foot wall of quartz vein.
4S238	do.	5.4	(165)	1	20	N	85	20	120	-	-	Limey schist with quartz stringers, minor sulfides.
						Quartz vein at 1300 foot elevation						
4S138	Selected grab	-	-	15	15	0.15	35	1300	250	N	20.6	Quartz vein, 2 to 3 ft thick.
4S140	do.	-	-	.5	N	N	5	40	90	-	-	Quartz vein, 3 ft thick.
						Other results - north section						
4S133	Selected grab	-	-	N	N	N	N	N	5	-	-	Float from 0.5 ft thick quartz vein.
4S135	do.	-	-	N	N	N	10	5	130	-	-	Quartz from iron-stained schist.
4S136	Channel	2.0	(61)	N	N	N	10	L	10	-	-	Quartz vein.
4S137	do.	.5	(15)	N	N	N	N	5	5	-	-	do.
4S141	Chip	2.5	(76)	N	N	N	25	55	35	-	-	Quartz vein.
4S251	Channel	.35	(11)	0.5	7	N	10	15	65	-	-	Quartz stringers and vein.
4S252	do.	4.5	(137)	.7	10	N	30	10	55	-	-	Schist with quartz stringers. Quartz comprises 60% of the rock.

Table 24.--Assay results, Taylor Lake area, continued.

Sample	Type	Length Ft.	Length (cm)	Semiquantitative Spectrographic Analysis ppm Ag	Mo	Atomic Absorption ppm Au	Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
						Other results - north section cont.						
4S253	Channel	4.0	(122)	L	N	N	20	15	40	-	-	Quartz vein.
4S254	do.	.4	(12)	1	N	N	50	40	100	-	-	Quartz vein.
4S255	do.	17.5	(533)	0.7	10	N	20	20	85	-	-	Schist with quartz stringers. Quartz comprises about 60% of the rock.
4S256	Spaced chip @ 1 ft interval	22	(671)	1	20	N.	85	20	210	-	-	Iron-stained schist.
4S257	Continuous chip	1.7	(52)	N	N	N	5	25	10	-	-	Limestone with quartz stringers.
4S258	do.	4.0	(122)	1.5	15	N	50	10	80	-	-	Iron-stained silicified schist.
						Other results - east section						
4S217	Channel	0.1	(3)	N	N	N	5	10	15	-	-	Quartz vein.
4S219	do.	1.6	(49)	1	30	N	40	20	40	-	-	Silicified graphitic schist with quartz vein.
4S220	do.	.9	(27)	.5	L	N	35	10	150	-	-	Quartz vein.
4S221	do.	.2	(6)	N	15	N	20	10	300	-	-	do.
4S222	do.	.4	(12)	L	N	N	20	10	55	-	-	do.
4S223	Selected grab	-	-	L	N	N	10	L	25	-	-	Silicified graphitic schist.
4S225	Channel	.25	(8)	L	N	N	20	15	L	-	-	Quartz vein.
4S226	do.	.2	(6)	.7	N	L	40	10	30	-	-	Graphitic schist, wall rock of above vein.
4S239	Chip	12.0	(366)	.5	20	N	30	20	160	-	-	Silicified graphitic schist with quartz stringers.
4S241	Channel	3.0	(91)	L	N	N	20	30	340	-	-	Graphitic schist with quartz stringers.
4S242	do.	1.8	(55)	L	5	N	20	10	85	-	-	Silicified graphitic schist.
4S243	do.	1.8	(55)	L	N	N	20	15	65	-	-	do.
4S244	Spaced chip, 0.5 ft interval	11	(335)	N	N	N	45	15	120	-	-	Graphitic schist with quartz stringers.
						Other results - west section						
4S265	Stream sediment	-	-	N	N	N	95	5	60	-	-	
4S266	do.	-	-	N	N	N	25	5	120	-	-	
4S267	Selected grab	-	-	N	N	N	80	5	30	-	-	Silicified gneiss
4S268	Spaced chip, 0.25 ft interval	3	(91)	N	N	N	85	5	10	-	-	Quartz vein

Quartz vein at a 1,300-foot elevation

A 2- to 3-foot thick quartz vein is exposed high on a cliff at an elevation of about 1,300 feet on the east bank of a stream that flows into the north end of Taylor Lake. This vein appears to cross-cut the structure of the graphitic schist, but its strike could not be physically determined on the steep cliff face. A representative grab sample (4S138) of this vein assayed 15 ppm silver, 0.15 ppm gold, 1,300 ppm lead and 250 ppm zinc.

Other results

Traverses and sampling along streams on the west, north and east sides of Taylor Lake did not indicate any additional significant values. Samples were taken of quartz veins or stringer zones in the graphitic phyllite or schist. Limestone was encountered at several locations and gneiss and magnetite-bearing rocks were exposed along a stream on the west side of Taylor Lake. (The magnetite-bearing ultramafic is discussed on p. 231). Figure 57 shows the sample locations. Of thirty samples taken in the area, a few were slightly anomalous. Eleven contained 0.5 to 1.5 ppm silver, one contained gold at below the measurable limit of 0.05 ppm, three contained 20-30 ppm molybdenum, one 55 ppm lead, and four 200-300 ppm zinc. Table 24 gives the assay returns.

Sumdum Glacier mineral belt

The Sumdum Glacier mineral belt contains the greatest number of significant metallic mineral resource occurrences in the study area. It is adjacent to the foliated tonalite sill that marks the southwestern edge of the Coast Range batholithic complex. The belt extends from Sweetheart Lake at the north end to the Holkam Bay prospect and probably beyond at the south end, and its width ranges from 0.6 to 1.2 miles. The total known length within the area studied is 32 miles. The Sumdum Chief gold mine is to the west of the belt. There are 12 specific mineralized areas. The following is a discussion of the 12 areas, starting at the north end.

1. Lower Sweetheart Lake to Tracy Arm elbow

A prominent, partly iron-stained linear depression one-fourth mile west of the tonalite contact which marks the east margin of the Sumdum Glacier mineral belt extends south from Lower Sweetheart Lake and through a 3,000-foot saddle to the elbow of Tracy Arm. It is aligned with the Tracy Arm zinc-copper prospect. Claims have been located in various places on and near this trend and include the Cook prospect reported near Sweetheart Lake, "Goldnest" claims reported near the pass, and the Arm claims group south of the pass near the Tracy Arm elbow (fig. 59).

Figure 59 near here.

Spencer (1904) referred to a galena prospect named the Cook group and reported (1906) a gold-quartz prospect carrying considerable galena and showed it northwest of Lower Sweetheart Lake near its outlet. Mining records prior to 1907 list three claims near the lake, two on the south side and one near the outlet, all staked by Frank Cook in July 1902.

This prospect could not be found during this study. However, 20 stream sediment samples and 19 spaced-chip, channel and grab samples were collected in the probable vicinity of the prospect. Results are given in table 25 and locations shown on the figure 59. Five stream

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TABLE 25 NEAR HERE.

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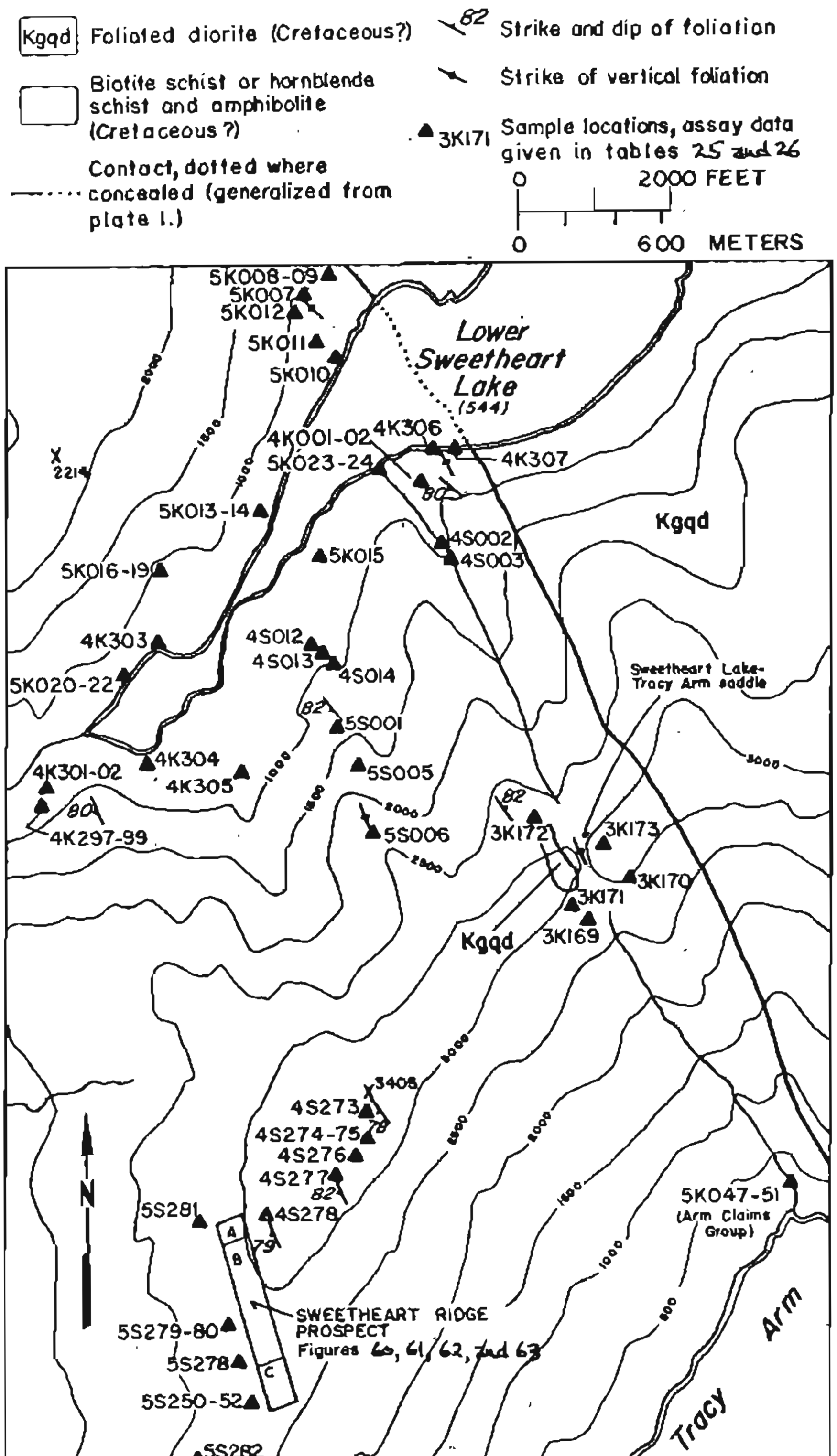
sediments from north shore drainage in schists near the diorite contact were slightly anomalous in lead; two of these contained 0.5 and 0.1 ppm in gold. Stream sediments from south shore drainages were not anomalous; however, up to 5 ppm silver, 330 ppm lead, 140 ppm zinc and 0.05 ppm gold were detected in three spaced-chip samples across a conspicuous iron-stained schist zone and its southward extension. Results of sampling and reconnaissance did not show one side of the lake as distinctly more favorable for mineralization than the other.

No claims were recorded near the lake after 1915, and there is no sign of recent activity.



Base from U.S. Geological Survey 1:63,360 Sumdum D-5 1955

Figure 59.--Lower Sweetheart Lake to Tracy Arm area, prospect and sample locations

Figure 59.--Lower Sweetheart Lake to Tracy Arm area, prospect and sample locations.

Table 25.--Assay data, Lower Sweetheart Lake to Tracy Arm area.

Sample	Type	Length Ft.	Length (m.)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption ppm Au	Cu	Pb	Zn	Description
				Lower Sweetheart Lake area					
4K001	Spaced chip, 1-ft. interval	16	(4.9)	0.7	N	70	15	120	Gneiss and schist.
4K002	do.	8	(2.4)	N	N	20	10	15	Fine-grained gneiss.
4K297	Spaced chip 0.25-ft. interval	39	(11.9)	N	N	200	10	560	Banded gneiss with pyrite.
4K298	Selected grab	-	-	N	N	230	10	95	High-grade selection of gneiss with pyrite.
4K299	Stream sediment	-	-	N	N	120	15	140	
4K301	do.	-	-	N	N	190	15	120	
4K302	Panned concentrate	-	-	N	N	140	10	85	
4K303	do.	-	-	N	N	35	5	40	Tributary on north side of lake.
4K304	do.	-	-	N	N	95	10	45	Tributary nearest outlet on S side of lake.
4K305	do.	-	-	N	N	30	5	20	Tributary 1/4 mile up lake on S side at foot of canyon.
4K306	Spaced chip, 1-ft. interval	22	(6.7)	N	N	80	10	90	Gneiss with pyrite along lake shore.
4K307	Selected grab	-	-	N	N	40	15	55	Iron-stained gneiss west of contact on lake shore.
4S002	Chip	5.0	(1.5)	0.5	N	160	40	400	Silicified phyllite with disseminated sulfides.
4S003	Spaced chip, 1-ft. interval	12	(3.7)	L	N	75	15	130	do.
4S012	Channel	.15	(.05)	N	N	10	5	L	Quartz vein.
4S013	do.	0.08	(.02)	N	N	220	10	10	do.
4S014	do.	1.5	(.5)	N	N	100	10	70	Silicified schist.
5K007	Spaced chip, 0.5-ft. interval	22.9	(7.0)	N	N	45	10	50	Biotite gneiss, thinly banded and schistose.

Table 25.--Assay data, Lower Sweetheart Lake to Tracy Arm area, continued.

Sample	Type	Length Ft.	Length (m.)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption ppm Au	Atomic Absorption ppm Cu	Atomic Absorption ppm Pb	Atomic Absorption ppm Zn	Description
				Lower Sweetheart Lake area cont.					
5K008	Stream sediment	-	-	N	N	60	15	140	
5K009	do.	-	-	N	N	20	15	130	
5K010	do.	-	-	N	N	30	15	120	
5K011	do.	-	-	N	N	30	10	120	
5K012	do.	-	-	N	N	30	10	130	
5K013	do.	-	-	N	N	40	5	65	
5K014	do.	-	-	N	N	35	5	70	
5K015	do.	-	-	N	N	30	5	65	
5K016	Spaced chip, 1-ft. interval	30	(9.1)	N	N	70	10	45	Biotite gneiss.
5K017	do.	18	(5.5)	N	N	35	10	15	Biotite gneiss with quartz banding parallel to foliation.
5K018	Stream sediment	-	-	N	N	50	10	6	
5K019	do.	-	-	N	N	65	10	60	
5K020	do.	-	-	N	N	50	5	55	
5K021	do.	-	-	N	N	55	10	60	
5K022	Selected grab	-	-	N	N	15	10	15	Quartz fragments from stream cobbles.
5K023	Stream sediment	-	-	N	N	55	10	110	
5K024	do.	-	-	N	N	60	10	110	
5S001	Chip	8	(2.4)	5	N	80	330	110	Iron-stained silicified schist and gneiss.
5S005	Spaced chip, 0.25-ft. interval	13	(4.1)	N	0.05	55	45	45	do.
5S006	Spaced chip, 0.5-ft. interval	9.5	(2.9)	N	N	35	140	45	do.
				Sweetheart Lake - Tracy Arm saddle					
3K169 1/	Chip	2.5	(0.8)	1.5	0.10	70	70	130	Quartz vein with abundant pyrite and sericite.
3K170	Channel	.4	(.1)	L	N	70	L	15	Quartz vein with minor pyrite.
3K171 2/	Selected grab	-	-	.5	7.0	40	950	75	Quartz vein float with arsenopyrite.
3K172	Spaced chip, 1-ft. interval	107	(32.6)	.5	N	65	10	90	Rusty-weathering schist.
3K173	Chip	.2	(.06)	.5	N	65	30	70	Quartz vein.

1/ Fire assay analysis gave N for Au and Ag.
2/ Atomic absorption analysis gave G10,000 ppm As. Fire Assay analysis gave N for Au and 3.1 ppm Ag.

Table 25.--Assay data, Lower Sweetheart Lake to Tracy Arm area, continued.

Sample	Type	Length Ft.	Length (m.)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption ppm Au	Cu	Pb	Zn	Description
				Arm Claims group					
5K047	Stream sediment	-	-	N	N	70	15	180	Main fork.
5K048	do.	-	-	N	N	40	10	85	East fork.
5K049	do.	-	-	N	N	65	15	200	Main fork.
5K050	Stream float composite	-	-	3	N	230	15	400	Rusty gneiss with quartz and much pyrrhotite.
5K051	do.	-	-	3	N	200	10	360	do.

Mining records indicate that several claims have been located in the general area of the 3,000-foot saddle which lies along the prominent linear depression between Sweetheart Lake and Tracy Arm. The Goldnest claims were recorded in 1912 near the head of the gulch just southeast of this saddle. A 3-foot thick, brecciated pyritic quartz vein has been explored with a short open cut in this area 300 feet below the saddle. The vein, which strikes N. 30 E. and dips steeply northwest is not exposed elsewhere. Analysis of a channel sample of the vein (3K169) reported small quantities of lead, arsenic, gold and silver (table 25) although later fire assay did not indicate gold or silver.

Sulfide-bearing quartz float boulders were found on the mountainside 200 feet above the breccia vein. The source could not be found although the size of the float indicates that the vein is at least 2 feet thick. Selected material from the float contained arsenic, lead, a little gold and a trace of silver (3K171) but does not represent the full vein width.

Conspicuously iron-stained gneiss between the saddle and the elbow of Tracy Arm occur in a steep gorge, part of the linear depression previously described. This area is covered by the Arm group (fig. 59) of four active claims which were recorded in 1974 as covering the lower part of the gorge down to tide line.

Two of three stream sediment samples collected in the gorge about 300 feet above sea level were slightly anomalous in zinc (table 25). Two other samples of select iron-stained float from the same area were slightly anomalous in silver, molybdenum, copper and zinc. This float clearly came down the gorge from heavily iron-stained gneiss upstream in the gorge. Some contains visible, sparsely disseminated pyrrhotite and traces of chalcopyrite detected petrographically. This depression generally aligns with the Tracy Arm zinc-copper prospect to the south.

2. Sweetheart Ridge mineralized zone

Significant gold and copper values believed to be hitherto unknown have been found in an iron-stained mineralized zone located west of Tracy Arm and a mile southwest of the pass previously described. Gold values range up to 0.557 ounces per ton across a 6-foot width, and copper values range up to 1.1 percent for a 4-foot width.

This mineralized zone consists of iron-stained schist and gneiss that follows the trend of the gray chlorite schist country rock for at least 2,000 feet and crosses the ridge between Tracy Arm and Lower Sweetheart Lake at an elevation of 2,900 feet. This ridge forms the Tracy Arm-Fords Terror Wilderness Study Area boundary. (This zone is located in the northwest striking, steeply dipping chlorite, phyllite and schist hornblende schist and gneiss of the hornblende schist and amphibolitic map units.) Figure 59 shows the location of the zone relative to Tracy Arm and figures 60, 61, and 62 show the area mapped

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Figures 60, 61, and 62 near here.

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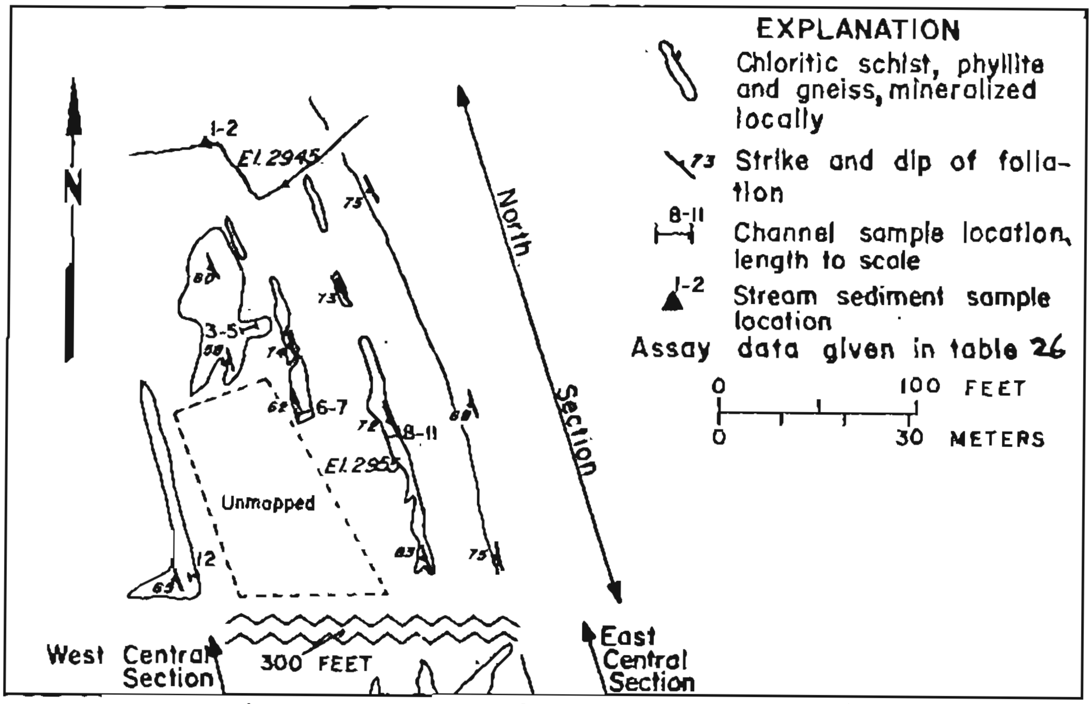
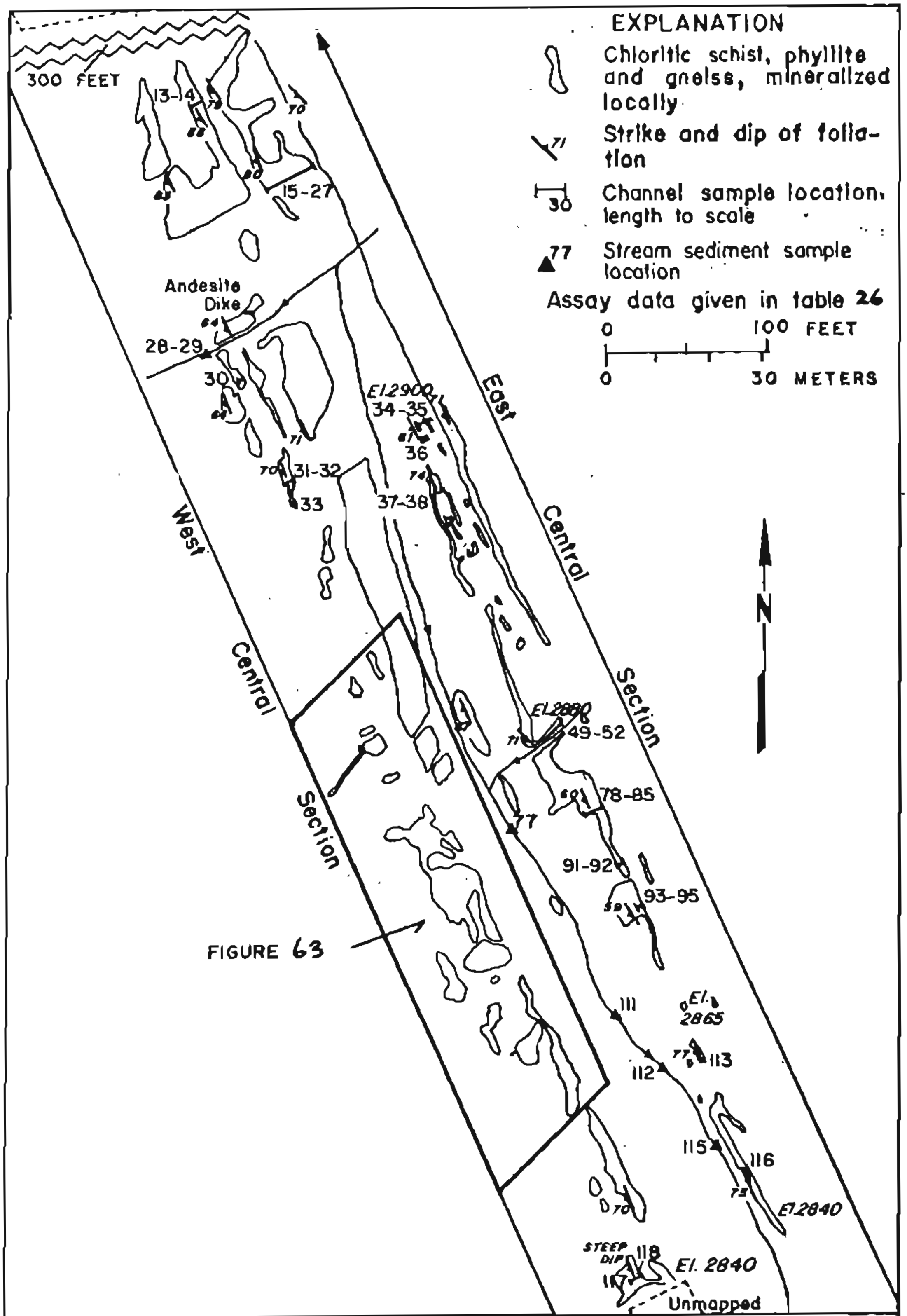
and sampled in it. The Elephant, Mastedon, Readgister and Golden Gate lode claims were staked in the general vicinity of the mineralized zone just before the turn of the century, but descriptions of location are not very specific. A rock geochemical grab sample from the vicinity taken in 1973 was anomalous in gold, mercury, copper and bismuth. The reported claims and the anomalous sample led to a brief examination in 1974, which indicated significant values in gold, silver, copper, lead and zinc. This led to a more comprehensive examination in 1975. Access to this prospect was gained by helicopter to a natural helipad in the vicinity. The area could also be reached on foot with some difficulty from Tracy Arm, Williams Cove or from Gilbert Bay.



Mapped by J. C. Still, W. L. Gnagy, K. Weir and J. Rataj, September 1975

Figure 60.-- Sweetheart Ridge prospect, north section, sample locations

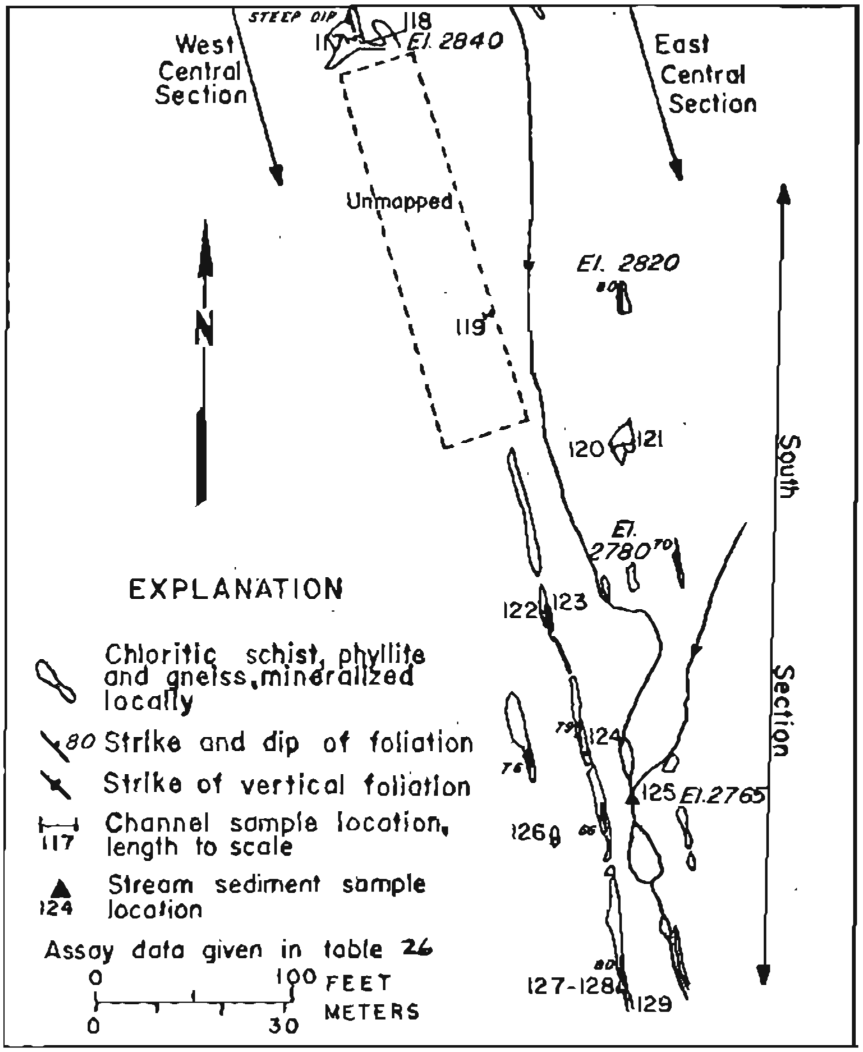
Figure 60.--Sweetheart Ridge prospect: North section, sample locations.



Mapped by J. C. Still, W. L. Gnagy, K. Weir and J. Rataj, September 1975

Figure 61.-- Sweetheart Ridge prospect, central section, sample locations

Figure 61.--Sweetheart Ridge prospect: Central section, sample locations.



Mapped by J. C. Still, W. L. Gnagy, K. Wier and J. Rataj, Sept. 1975

Figure 62 Sweetheart Ridge prospect, south section, sample locations

Figure 62.--Sweetheart Ridge prospect: South section, sample locations.

A structural depression apparently caused by differential weathering of chlorite schist separates the altered zone into an eastern and western portion. Outcrops are sparse. Turf and rubble cover most of the altered zone, making it difficult to trace mineralized portions of it for any distance along strike. Snow cover common until late August compounds the problem. Study of aerial photographs and brief examination from the air show that the linear depression can be traced from Tracy Arm to Sweetheart Lake, a horizontal distance of 5.5 miles over an elevation change of 3,000 feet.

The iron-stained mineralized zone is layered and grades from phyllite to schist to quartz-rich gneiss. The mineralized zone rocks contain abundant chlorite and quartz, subordinate biotite, muscovite, garnet and epidote with traces of geothite and hornblende. The sulfides are both disseminated and in thin layers and consist largely of chalcopyrite and pyrite with occasional sphalerite and rarely galena. Disseminated pyrite and chalcopyrite are concentrated in layers within the zone that aligns with the foliation. Layers containing chalcopyrite are found throughout the zone. Figures 60 through 62 are maps showing outcrop and sample locations in the 2,000-foot long area examined. Table 26 gives the assay results.

TABLE 26 NEAR HERE.

Table 26.--Assay data, Sweetheart Ridge prospect.

Sample		Type	Length		Semiquantitative Spectrographic Analysis ppm		Atomic Absorption ppm				Fire Assay ppm		Description
			Ft.	(m.)	Ag	Mo	Au	Cu	Pb	Zn	Au	Ag	
						Northern section							
1 1/	(5S267a)	Stream sediment	-	-	N	N	N	240	20	70	-	-	
2	(5S267b)	do.	-	-	N	N	N	210	15	60	-	-	
3	(5S262a)	Channel	1.2	(.4)	10	N	.80	17000	25	220	N	7.9	Gneiss with pyrite and chalcopyrite.
4	(5S262b)	do.	1.5	(.5)	5	N	.40	11000	20	120	N	10.3	do.
5	(5S262c)	Chip	6.0	(1.8)	N	N	N	120	15	55	N	5.1	do.
6	(5S261a)	Chip	4.0	(1.2)	3	N	0.60	4700	20	75	N	.7	Gneiss with sulfides.
7	(5S261b)	do.	4.0	(1.2)	2	N	.10	2300	25	100	N	9.6	do.
8	(5S264a)	do.	.6	(.2)	N	N	N	380	10	25	N	1.4	Gneiss with sulfides.
9	(5S264b)	do.	2.2	(.7)	.7	N	N	1500	10	25	N	1.4	do.
10	(5S264c)	do.	1.7	(.5)	10	N	.60	20000	10	170	N	N	do.
11	(5S264d)	do.	2.2	(.7)	5	N	.90	2500	10	60	N	3.8	
12	(5S263)	do.	4.8	(1.5)	N	10	N	70	10	45	N	6.2	Gneiss.
						Central section							
13	(5S265a)	Channel	5.0	(1.5)	2	N	.10	2300	20	100	N	4.5	Gneiss with sulfides.
14	(5S265b)	do.	5.0	(1.5)	L	15	L	610	15	100	N	6.9	do.
15	(5S268Ia)	Chip	2.0	(.6)	1.5	N	.05	1100	10	45	N	8.2	Phyllite or fine-grained gneiss with quartz lenses, pyrite and chalcopyrite.
16	(5S268Ib)	do.	5.0	(1.5)	L	N	N	110	10	25	N	8.9	Phyllite or fine-grained gneiss with pyrite and thin bands of garnet.
17	(5S268Ic)	do.	6.0	(1.8)	L	N	.10	110	10	30	N	.3	Phyllite or fine-grained gneiss with pyrite and chalcopyrite.
18	(5S268IIa)	do.	1.0	(.3)	N	N	N	260	10	35	N	2.4	Silicified gneiss with chalcopyrite.
19	(5S268IIb)	do.	.3	(.09)	L	N	N	200	10	35	N	2.1	
20	(5S268IIc)	do.	.6	(.2)	7	10	.20	2000	30	50	N	6.5	Limonite-stained gneiss. Sulfides leached out.

Table 26.--Assay data, Sweetheart Ridge prospect, continued.

	Sample	Type	Length Ft.	Length (m)	Semiquantitative Spectrographic Analysis ppm Ag	Mo	Atomic Absorption ppm Au	Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
							Central section-continued						
21	(5S268IId)	Channel	.7	(.2)	7	N	.20	17000	25	80	N	19.2	Gneiss with chalcopyrite, pyrite and bornite.
22	(5S268IIe)	do.	.7	(.2)	3	N	.10	860	30	55	N	13.0	Intensely iron-stained gneiss with sulfides leached out.
23	(5S268IIIe)	do.	3.0	(.9)	.5	5	N	170	20	60	N	7.5	do.
24	(5S268IIId)	do.	4.2	(1.3)	1.5	N	N	1400	20	45	N	5.5	do.
25	(5S268IIIc)	do.	3.4	(1.1)	3	N	.10	4300	10	55	N	9.6	do.
26	(5S268IIIb)	do.	4.6	(1.4)	.5	N	N	290	10	110	N	20.9	Gneiss with sulfides.
27	(5S268IIIa)	Chip	1.0	(.3)	.5	N	N	460	10	230	N	11.3	Gneiss.
28	(5S271a)	Stream sediment	-	-	N	10	N	250	35	45	-	-	
29	(5S271b)	do.	-	-	N	N	N	240	40	45	-	-	
30	(5S270)	Chip	2.8	(.9)	1	N	N	400	15	55	N	12.7	Gneiss.
31	(5S266a)	do.	5.5	(1.7)	.5	N	.05	800	10	35	N	4.5	Gneiss with few sulfides.
32	(5S266b)	Channel	.7	(.2)	.5	N	.05	1100	15	50	-	-	
33	(5S269)	Chip	2.0	(.6)	3	N	.20	5000	10	40	N	11.0	do.
34	(5R001a)	do.	5.0	(1.5)	5	N	N	4800	20	120	N	3.4	Gneiss with some gossan with sulfides.
35	(5R001b)	do.	3.0	(.9)	.7	N	N	570	10	60	N	7.6	Gneiss, 75% gossan, with sulfides.
36	(5R002)	do.	2.0	(.6)	3	N	N	5600	20	140	N	5.5	Gneiss with sulfides.
37	(5R003a)	do.	5.0	(1.5)	3	15	.10	4200	15	60	N	7.5	do.
38	(5R003b)	do.	5.0	(1.5)	5	N	.10	1900	15	65	N	12.3	do.
39	(5S254a)	Chip	2.9	(.9)	1	N	N	540	10	55	N	8.2	do.
40	(5S254b)	do.	.9	(.3)	2	N	N	2000	10	60	N	13.7	do.
41	(5S254c)	Chip	1.9	(0.6)	.5	N	N	180	10	75	N	6.5	do.
42	(5S255b)	Channel	1.1	(.3)	L	N	.05	300	60	80	N	6.2	do.
43	(5S255a)	do.	5.5	(1.7)	2	5	3.5	1600	70	350	0.2	8.9	do.
44	(5S121)	Chip	1.3	(.4)	N	N	N	130	10	10	-	-	Quartz vein.
45	(5S120)	do.	4.3	(1.3)	20	50	1.5	4600	280	940	6.5	.7	Moderately iron-stained gneiss.
46	(5S253b)	Channel	4.0	(1.2)	2	10	.70	2000	85	180	N	11.7	Gneiss and iron-stained gneiss.

Table 26.--Assay data, Sweetheart Ridge prospect, continued.

Sample		Type	Length		Semiquantitative Spectrographic Analysis ppm		Atomic Absorption ppm				Fire Assay ppm		Description
			Ft.	(m.)	Ag	Mo	Au	Cu	Pb	Zn	Au	Ag	
							Central section cont.						
47	(5S253a)	Channel	5.0	(1.5)	7	30	3.5	2200	630	1500	N	4.8	Gneiss and iron-stained gneiss.
48	(5S272)	Stream sediment	-	-	N	N	N	190	25	40			
49	(5R007a)	Channel	2.0	(.6)	.5	N	N	900	10	40	.03	14.1	Iron-stained gneiss, about 10% gossan, with quartz lenses, chalcopyrite, pyrite and bornite.
50	(5R007b)	do.	5.4	(1.6)	L	N	N	260	10	30	N	1.0	do.
51	(5R006)	do.	4.6	(1.4)	3	10	.10	5800	10	55	N	.3	do.
52	(5R005)	do.	.7	(.2)	L	N	N	1300	10	45	N	.7	do.
53	(5S257a)	Soil sample	-	-	N	N	.05	35	40	15	-	-	6 ft. west of gold-bearing quartzose gneiss.
54	(5S257b)	do.	-	-	N	N	.60	40	40	25	-	-	4 ft. west of gold-bearing quartzose gneiss.
55	(5S257c)	do.	-	-	N	N	-	60	35	30	-	-	In gold-bearing quartzose gneiss.
56	(5S257d)	do.	-	-	N	L	.10	180	35	20	-	-	do.
57	(5S257e)	do.	-	-	N	L	.15	450	50	55	-	-	do.
58	(5S257f)	do.	-	-	.5	N	.40	510	160	70	-	-	do.
59	(5S257g)	do.	-	-	N	N	.15	380	240	55	-	-	do.
60	(5S257h)	do.	-	-	N	N	.05	200	55	110	-	-	2 ft. east of gold-bearing quartzose gneiss.
61	(5S257i)	do.	-	-	N	N	.05	370	15	30	-	-	4 ft. east of gold-bearing quartzose gneiss.
62	(5S072)	Chip	6.8	(2.1)	N	N	N	30	5	35	-	-	Gneiss.
63	(5S071)	do.	4.6	(1.4)	N	N	N	5	5	20	-	-	Slightly iron-stained gneiss.
64	(5S067)	Channel	5.1	(1.6)	1	N	N	260	5	15	-	-	Quartz fragments and gneiss in lenticular structure (about 60% quartz.)
65	(5S070)	Chip	7.0	(2.1)	N	5	N	190	20	55	-	-	Moderately iron-stained gneiss.
66	(5S069)	Channel	5.0	(1.5)	30	N	15	7700	770	2500	3.9	.3	Intensely iron-stained cataclastic gneiss with pyrite and chalcopyrite.
67	(5S068)	do.	4.6	(1.4)	L	N	0.1	340	10	60	-	-	Moderately iron-stained gneiss.
68	(5S073)	do.	5.0	(1.5)	30	70	8	5000	200	1000	6.1	4.8	Intensely iron-stained cataclastic quartzose gneiss.

Samples 53-61: Samples @2-ft. interval. Sample line perpendicular to altered zone.

Table 26.--Assay data, Sweetheart Ridge prospect, continued.

Sample		Type	Length Ft.	Length (m.)	Semiquantitative Spectrographic Analysis ppm Ag	Semiquantitative Spectrographic Analysis ppm Mo	Atomic Absorption ppm Au	Atomic Absorption ppm Cu	Atomic Absorption ppm Pb	Atomic Absorption ppm Zn	Fire Assay ppm Au	Fire Assay ppm Ag	Description
						Central section cont							
69	(5S114)	Selected grab	-	-	100	200	29.0	26000	18000	16000	24.0	37.7	Selection of intensely iron-stained cataclastic quartzose gneiss; shallow sample over 5S074.
69	(5S074)	Chip	5.4	(1.6)	50	70	11	9300	2300	5200	5.2	4.5	Intensely iron-stained cataclastic quartzose gneiss.
70	(5S258a)	Soil sample	-	-	N	N	-	85	50	50	-	-	3 ft. west of gold-bearing quartzose gneiss.
71	(5S258b)	do.	-	-	N	N	.20	190	60	210	-	-	In quartzose gneiss.
72	(5S258c)	do	-	-	.7	N	.60	150	50	45	-	-	do.
73	(5S258d)	do.	-	-	.5	N	.20	290	60	70	-	-	do.
74	(5S258e)	do.	-	-	N	N	N	150	35	90	-	-	do.
75	(5S258f)	do.	-	-	N	N	N	230	60	150	-	-	2 ft. east of gold-bearing quartzose gneiss.
76	(5S258g)	do.	-	-	N	N	N	150	45	110	-	-	4 ft. east of gold-bearing quartzose gneiss.
77	(5S273)	Stream sediment	-	-	N	N	N	180	30	40			
78	(5R008a)	Chip	1.5	(.5)	2	N	L	3200	10	50	N	2.7	Gneiss with quartz lenses, quartzite band and chalcopyrite.
79	(5R008b)	do.	1.7	(.5)	3	7	N	2400	15	40	N	1.0	do.
80	(5R008c)	do.	1.3	(.4)	2	N	N	900	10	25	N	.7	do.
81	(5R008d)	do.	1.8	(.5)	3	N	N	6700	15	55	N	8.2	do.
82	(5R008e)	do.	1.4	(.4)	1	N	L	1500	10	50	N	.7	do.
83	(5R008f)	do.	3.9	(1.2)	.7	N	N	490	15	40	N	3.4	do.
84	(5R008g)	do.	1.4	(.4)	5	N	.10	7600	20	95	N	.3	do.
85	(5R008h)	do.	.5	(.2)	1.5	N	N	940	15	50	N	5.8	do.
86	(5S078)	do.	9.5	(2.9)	N	N	N	75	15	80	-	-	Slightly iron-stained gneiss.

Samples 70–76: Samples 02-ft. interval. Sample line perpendicular to altered zone.

Table 26.--Assay data, Sweetheart Ridge prospect, continued.

Sample		Type	Length		Semiquantitative Spectrographic Analysis ppm		Atomic Absorption ppm				Fire Assay ppm		Description
			Ft.	(m.)	Ag	Mo	Au	Cu	Pb	Zn	Au	Ag	
					Central section cont								
87	(5S077)	Channel	6.0	(1.8)	30	70	9.5	3900	350	1200	8.3	11.7	Intensely iron-stained cataclastic quartzose gneiss.
87	(5S113)	Chip	6.0	(1.8)	50	70	30.0	1400	350	120	16.3	13.4	Intensely iron-stained cataclastic quartzose gneiss, shallow sample over 5S077.
88	(5S076)	do.	5.0	(1.5)	N	N	N	230	35	300	-	-	Moderately iron-stained gneiss.
89	(5S075)	do.	7.5	(2.3)	N	N	N	170	10	45		-	Moderately iron-stained gneiss with quartz veins.
90	(5S079)	Channel	6.0	(1.8)	50	50	20	2100	1800	1400	19.8	19.9	Intensely iron-stained cataclastic quartzose gneiss.
90	(5S112)	Chip	6.0	(1.8)	70	70	10.0	3600	260	440	12.0	16.1	Intensely iron-stained cataclastic quartzose gneiss; shallow sample over 5S079.
91	(5R009a)	do.	2.1	(.6)	L	N	N	250	10	25	N	3.8	Gneiss.
92	(5R009b)	Channel	2.3	(.7)	2	N	N	3100	15	75	N	.3	Gneiss with chalcopyrite.
93	(5R010a)	do.	1.7	(.5)	10	N	N	17000	15	270	N	3.8	Gneiss with pyrite, chalcopyrite, and bornite.
94	(5R010b)	do.	.5	(.2)	1	N	N	680	5	20	N	6.2	Quartz vein with sulfides.
95	(5R010c)	do.	1.2	(.4)	7	N	.10	7000	15	15	N	L	Gneiss with sulfides.
96	(5S111)	Channel	5.5	(1.7)	50	30	5.0	8400	1800	4500	6.1	22.3	Intensely iron-stained cataclastic quartzose gneiss with pyrite, chalcopyrite, azurite and malachite.

Table 26.--Assay data, Sweetheart Ridge prospect, continued.

Sample		Type	Length		Semiquantitative Spectrographic Analysis ppm		Atomic Absorption ppm				Fire Assay ppm		Description
			Ft.	(m.)	Ag	Mo	Au	Cu	Pb	Zn	Au	Ag	
97	(5S259a)	Soil sample	-	-	1	N	.20	260	190	140	-	-	8 ft. west of gold-bearing quartzose gneiss.
98	(5S259b)	do.	-	-	.7	N	N	230	160	130	-	-	6 ft. west of gold-bearing quartzose gneiss.
99	(5S259c)	do.	-	-	N	N	N	180	90	95	-	-	4 ft. west of gold-bearing quartzose gneiss.
100	(5S259d)	do.	-	-	N	N	N	200	110	95	-	-	2 ft. west of gold-bearing quartzose gneiss.
101	(5S259e)	do.	-	-	N	N	N	200	90	95	-	-	In quartzose gneiss.
102	(5S259f)	do.	-	-	N	N	N	230	130	100	-	-	do.
103	(5S259g)	do.	-	-	.7	N	N	360	170	140	-	-	do.
104	(5S259h)	do.	-	-	.5	N	.10	310	140	110	-	-	2 ft. east of gold-bearing quartzose gneiss.
105	(5S259i)	do.	-	-	.7	N	.10	250	120	90	-	-	4 ft. east of gold-bearing quartzose gneiss.
106	(5S259j)	do.	-	-	N	N	.10	250	130	70	-	-	6 ft. east of gold-bearing quartzose gneiss.
107	(5S110)	Channel	5.6	(1.7)	100	50	7.0	8400	5900	19000	6.0	5.1	Intensely iron-stained cataclastic quartzose gneiss.
108	(5S260)	Chip	1.7	(.5)	N	N	N	50	5	10	N	7.2	Gneiss with sulfides.
109	(5S115)	Channel	6.0	(1.8)	N	N	.10	150	65	80	N	.3	Moderately iron-stained gneiss.
110	(5S116)	Chip	5.0	(1.5)	7	N	.05	3500	10	25	N	N	Moderately iron-stained gneiss.
111	(5S274)	Stream sediment	-	-	N	N	N	170	25	40			
112	(5S275)	do.	-	-	N	N	N	250	30	45			
113	(5R011)	Channel	1.5	(.5)	5	N	.05	5300	10	35	N	3.4	Gneiss with quartz vein and chalcopyrite.
114	(5S117)	Chip	6.0	(1.8)	N	N	N	570	10	20	-	-	Moderately iron-stained gneiss.
115	(5S276)	Stream sediment	-	-	N	N	N	210	25	40			
116	(5R012)	Chip	2.9	(.9)	5	N	.05	5500	10	50	N	4.1	Gneiss with 0.3-ft. wide band of massive sulfides.
117	(5S118)	do.	5.0	(1.5)	N	N	N	150	5	30	-	-	Moderately iron-stained gneiss with quartz veins.
118	(5S119)	do.	3.4	(1.0)	2	N	N	1900	5	35	-	-	do.

Samples 97-106: Samples @2-ft. interval. Sample line perpendicular to altered zone.

Table 26.--Assay data, Sweetheart Ridge prospect, continued.

Sample		Type	Length Ft.	(m.)	Semiquantitative Spectrographic Analysis ppm Ag	Mo	Atomic Absorption ppm Au	Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
							Central section cont						
119	(5R020)	Chip	2.0	(.6)	15	N	.45	22000	15	200	N	6.9	Gneiss with sulfides.
120	(5S277a)	do.	6.0	(1.8)	1	5	N	210	15	70	-	-	do.
121	(5S277b)	do.	5.6	(1.7)	.7	5	L	820	20	90	-	-	do.
122	(5R016a)	do.	2.7	(.8)	7	10	.10	15000	15	550	N	4.1	do.
123	(5R016b)	do.	2.3	(.7)	2	20	.05	2500	10	80	N	1.4	do.
124	(5R017)	do.	2.0	(.6)	2	10	N	3000	10	90	N	4.1	do.
125	(5R018)	Stream sediment	-	-	.5	N	N	270	65	65			
126	(5R015)	Chip	3.5	(1.1)	1	N	.10	410	20	85	N	3.8	do.
127	(5R013a)	do.	1.9	(.6)	2	N	N	3300	10	200	N	4.1	do.
128	(5R013b)	do.	2.9	(.9)	3	N	N	6100	10	750	N	9.3	do.
129	(5R014)	do.	2.5	(.8)	1.5	N	N	1200	10	75	N	1.7	do.
							Other investigations in the vicinity of Sweetheart Ridge prospect - area between Peak 3405 and						
	4S273	Channel	0.8	(.2)	1	N	N	25	5	25	-	-	Quartz stringer zone in gneiss.
	4S274	Spaced chip, 1-ft. interval	21	(6.4)	N	N	N	5	5	65	-	-	Iron-stained gneiss.
	4S275	Spaced chip, 0.5-ft. interval	15	(4.6)	1	N	N	65	20	60	-	-	do.
	4S276	Channel	5.0	(1.5)	N	N	N	25	10	110	-	-	Yellow-stained gneiss.
	4S277	do.	2.4	(.7)	N	N	N	15	5	20	-	-	Iron-stained gneiss.
	4S278	do.	5.0	(1.5)	N	N	N	80	5	20	-	-	do.
							Other investigations - west shore of Tracy Arm						
	5S102	Chip	6.0	(1.8)	N	N	N	180	60	940	-	-	Iron-stained gneiss.
	5S103	do.	5.0	(1.5)	N	N	N	35	10	90	-	-	do.
	5S104	do.	3.0	(.9)	N	N	N	75	20	790	-	-	do.
	5S105	do.	6.7	(2.0)	N	N	N	5	5	20	-	-	do.
	5S106	do.	4.0	(1.2)	L	5	N	55	10	200	-	-	do.
	5S107	do.	3.0	(.9)	1	5	N	35	20	200	-	-	do.
	5S108	do.	5.0	(1.5)	N	5	N	5	10	70	-	-	do.
	5S109	do.	4.0	(1.2)	N	L	N	25	10	130	-	-	do.

Table 26.--Assay data, Sweetheart Ridge prospect, continued.

Sample	Type	Length		Semiquantitative Spectrographic Analysis ppm		Atomic Absorption ppm				Fire Assay ppm		Description
		Ft.	(m.)	Ag	Mo	Au	Cu	Pb	Zn	Au	Ag	
Other investigations - mineralized zone 400 feet west												
5S250	Chip	3.3	(1.0)	.5	N	N	130	15	200	N	3.1	Iron-stained gneiss.
5S251	do.	4.1	(1.3)	3	N	N	110	10	130	N	16.8	Gneiss with quartz lenses.
5S252a	Channel	5.0	(1.5)	3	N	.05	240	15	190	N	7.5	Iron-stained gneiss.
5S252b	do.	5.0	(1.5)	2	N	.05	230	20	200	N	9.9	do.
5S278	Chip	3.7	(1.1)	2	N	L	220	150	1200	N	1.7	do.
5S279	Spaced chip @	5.5	(1.7)	.5	N	N	140	20	60	N	5.5	Gneiss with sulfides.
5S280	0.25-ft. interval	5.5	(1.7)	.5	N	N	90	5	40	N	.3	Iron-stained gneiss with sulfides
5S281	Spaced chip @ 0.5-ft. interval	13	(4.0)	.5	5	N	80	5	30	N	3.8	Iron-stained gneiss.
Other investigations - mineralized zone 1200 feet west of												
5S282	Spaced chip @ 0.5-ft. interval	15	(4.6)	L	N	N	140	10	45	N	.3	Gneiss with finely disseminated pyrite and chalcopyrite.

1/ Refer to figures 60-63

The most important mineralized band thus far discovered is located in the west-central section and consists of cataclastic quartz-rich gneiss 5 to 6 feet thick capped by intense orange-red iron stain. Figure 63 is a map of the geology and sample locations for this section, which

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Figure 63 near here.

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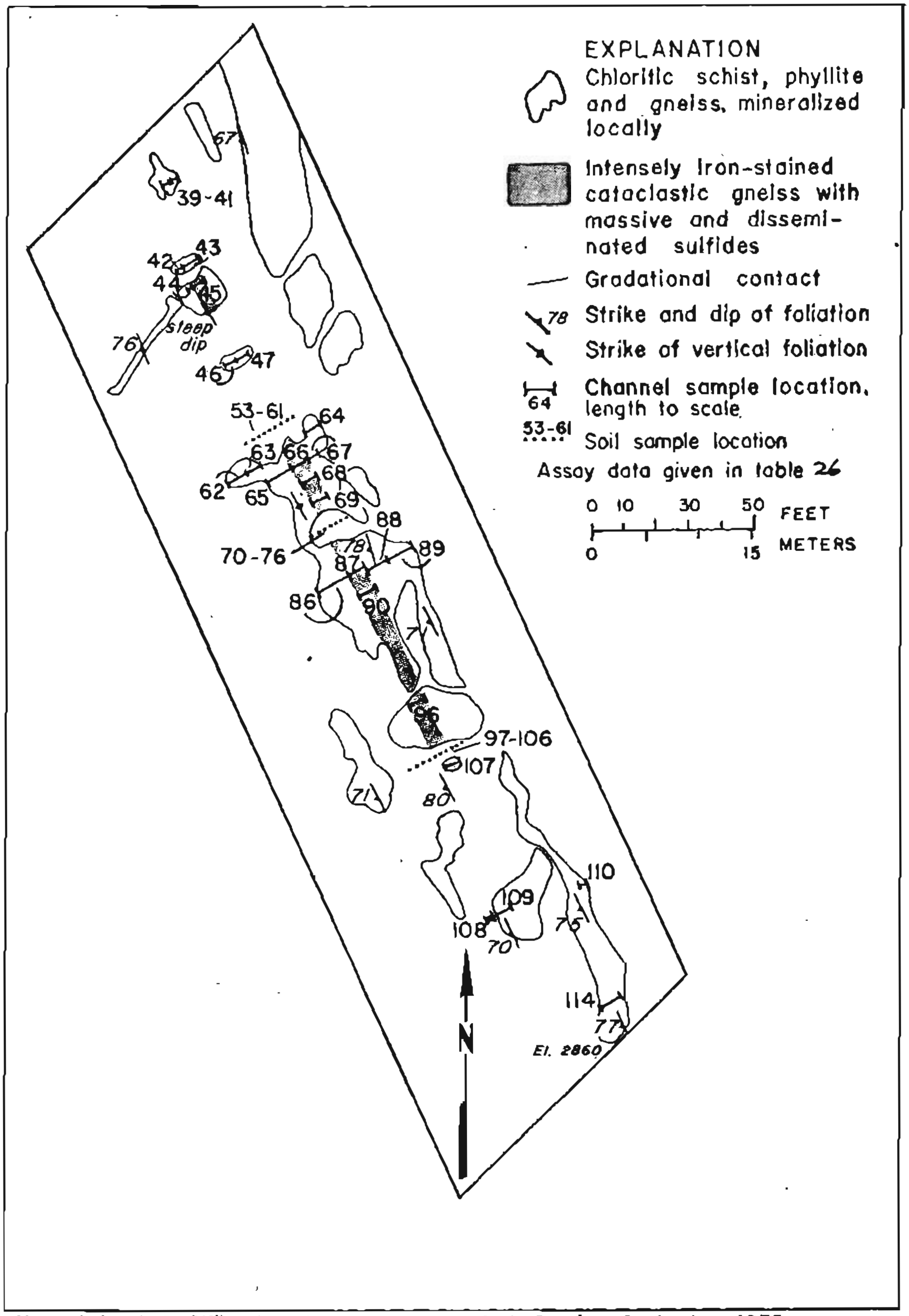
is referred to here as the Sweetheart Ridge prospect. Petrographic examination did not reveal secondary sulfide enrichment or residual gold concentrations associated with this capping. Sampling reveals that a 147-foot strike length of this iron-stained capped gneiss contained the most significant values in gold. Channel and chip samples, 5 to 6 feet long, had values ranging from 0.114 to 0.577 ounces gold per ton, 0.01 to 0.65 ounces silver per ton, and 0.21 to 0.93 percent copper for the 147-foot-long best section. A rough determination of the average width, tonnage and grade of the exposed portion of the 147-foot zone section was made by considering the influence of each sample to extend halfway to adjacent samples, both within the zone and at the ends; it infers that there are about 7,300 tons per 100 feet of depth with an average width of 5.5 feet and an average grade of 0.23 ounces gold per ton, 0.31 ounces silver per ton, and 0.7 percent copper for this best 147-foot-long section. The location of this section is shown in figure 63.

Intermittent outcrops align with the strike of the gold-rich gneiss for 50 feet past the north end of this 147-foot best section. Samples taken of these outcrops and in one pit assay between 0.21 and 6.5 ppm gold, and from 0.16 to 0.46 percent copper. There are no outcrops north of sample 42 and 43 (figure 63) taken in a pit that align with the strike of the gold-rich gneiss. Trenching through thin soil cover will be necessary to determine its northerly extent. Examination of outcrops and sample results indicate that the gold-rich gneiss does not continue to the south in the area exposed by outcrops.

Samples taken of the soil over the 147-foot-long gold-bearing zone near a channel sample containing gold, with a hand auger, contain up to 0.60 ppm gold. Soil sample locations are shown in figure 63. This indicates that soil sampling may be a tool in locating gold-bearing layers in the 200-foot-wide mineralized zone where it is covered by soil.

The remainder of the altered zone (excluding the gold-rich gneiss) consistently contained gold up to 0.9 ppm, silver up to 20.9 ppm, and copper up to 2 percent. The higher silver content was not necessarily related to the amount of copper or gold. Not enough is known about the bands of mineralization to be able to calculate average grade or tonnage.



Mapped by J. C. Still, W. L. Gnagy, K. Weir and J. Rataj, September 1975

Figure 63.-- Sweetheart Ridge prospect, west central section detail, sample locations

Figure 63.--Sweetheart Ridge prospect: West central section detail, sample locations.

Although most of the 2,000-foot mapped portion of the altered zone is covered by soil and turf, most of the outcrops were briefly examined and evident bands of mineralization were sampled. Time and vegetative cover did not permit close examination of the immediate areas on either side of the zone or the possible extension of the zone. Field and petrographic examination suggest that this deposit is possibly of sedimentary origin. If so, persistence of metallic mineralization along strike and down dip might be expected. The area warrants additional exploration based on the 2,000-foot-long traceable mineralization, widths up to six feet, and grades ranging up to 0.5 ounces per ton gold, 1.1 percent copper, and some silver and zinc.

3. Other investigations in the vicinity of Sweetheart Ridge mineralized zone

A brief reconnaissance investigation was made of stained zones exposed in the area between the mineralized zone and the summit of peak 3405 to the northeast. Figures 59 and 64 show the sample locations and

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Figure 64 near here.

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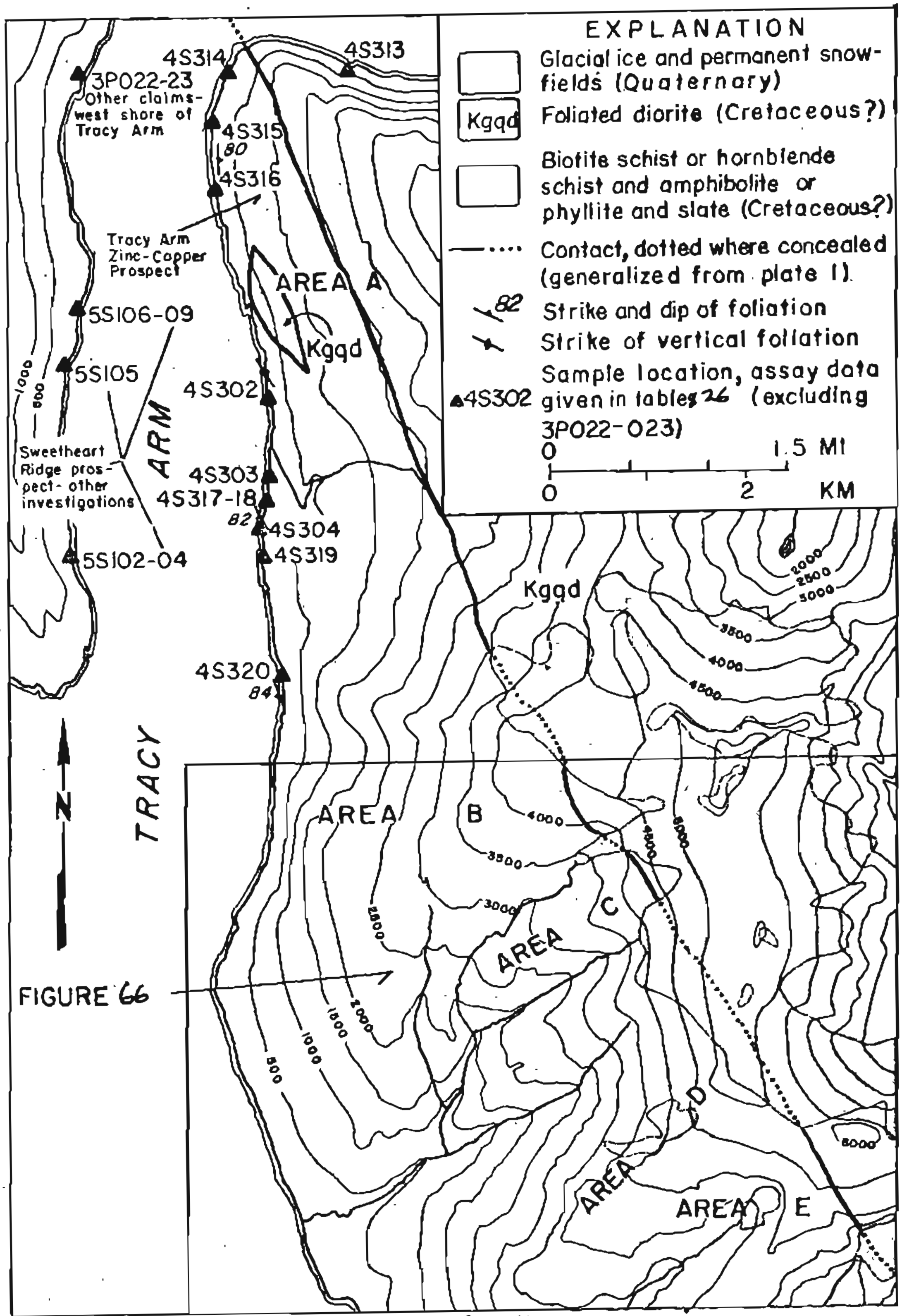
table 26 gives the sample results. These stained zones follow the structure of the schist and gneiss in the area and, for the most part, consist of iron-stained gneiss with very minor disseminated pyrite. Sampling did not reveal any significant metal concentrations.

A more thorough investigation was made of the mineralized zone about 400 feet west of the Sweetheart Ridge mineralized zone and parallel to it. Eight samples were taken along this zone (samples 5S250-252, 5S278-281 in fig. 69) of the more promising outcrops distributed 2,500 feet along strike. The samples were chip or spaced-chip samples from 3.3 to 13 feet long. Three samples contained traces of gold, four samples from 5.5 to 16.8 ppm silver, and three contained from 200 to 1,200 ppm zinc. The rest of the sample results are shown in table 26. About 1,200 feet southwest of the above-discussed mineralized zone is another zone which was sampled (4S282) at one location, but no significant metal concentrations were found.

A brief reconnaissance was made of stained zones exposed in cliffs along the western edge of Tracy Arm. Figure 64 shows the sample locations and table 26 gives the sample results. Chip samples from one zone of stained gneiss with disseminated pyrite (5S102-5S104) contained up to 940 ppm zinc. This zone is roughly aligned with the main mineralized zone, but a long distance to the south. Chip samples from another zone (5S106-5S109) of stained gneiss with disseminated pyrite contained a trace of gold and up to 200 ppm zinc.



Base from U.S. Geological Survey 1:63,360 Sumdum D-5 1955

Figure 64.--Sumdum glacier mineral belt between Sumdum copper-zinc prospect and Tracy Arm

Figure 64.--Sumdum Glacier mineral belt between Sumdum copper-zinc prospect and Tracy Arm.

4. Tracy Arm zinc-copper prospect

This property, also known as the Jingle Jangle, Neglected Prize and Tracy prospect, lies in the crook of the major Tracy Arm elbow 8.5 miles northwest of Mount Sumdum on a bench about one-fourth mile east of shoreline (Plate 3 and fig. 65). Banded pyrrhotite, sphalerite, and

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Figure 65 near here.

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chalcopyrite in a well defined zone parallel foliation in hornblende-plagioclase to hornblende-biotite gneiss. The zone is exposed in 22 shallow open cuts and a 16-foot shaft. The open cuts are distributed along strike for 1,150 feet and range in elevation from 740 feet to 850 feet. The width of the zone ranges from 1 to 10 feet. The mineralization strikes N. 20 to 30 W. with a nearly vertical dip. In spite of rugged topography and thin overburden, bedrock exposures are sparse. Heavy brush and spruce and hemlock timber up to 18 inches in diameter form a dense growth over the area.

The sulfide zone was discovered in 1916 and had been explored by nine open cuts and a 16-foot shaft along a strike length of 500 feet by 1923. Subsequent work increased the number of cuts (including the shaft) to 23, exposing more of the zone along the strike length. The zone was staked in 1922-23 as the Neglected Prize #1-3, in 1942-43 as the Jingle Jangle, Jongle, Jungle, and 13 other claims, in 1958 as the Jangle, North Jangle and 5 other claims, and in 1965-66 as the 34 Tracy claims. Tracy claims numbered 4-24 in slightly different configurations than the original Tracy claims were active in 1975. Four millsite locations were recorded in 1974 on the west shore of Tracy Arm. There is no record of production from this property.

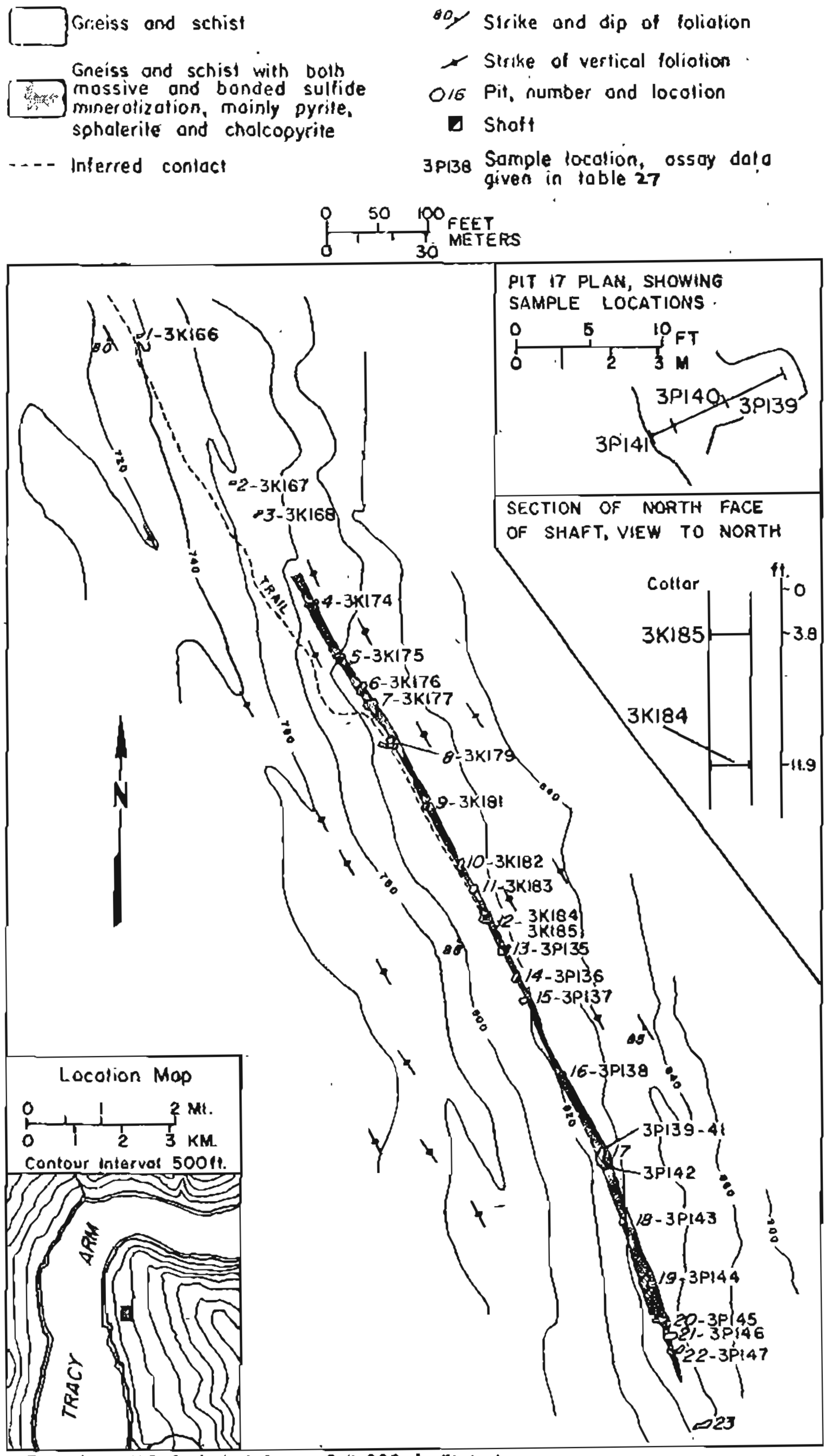
The prospect was examined by Buddington (1923), by Roehm (1942), and by the Bureau of Mines in 1943. Reed and Twenhofel also briefly examined the prospect in 1943 and their recommendation resulted in detailed work by Gault and Fellows in 1944 (1953) under the strategic minerals program.

During the present study access to the prospect was gained on foot from a cleared helipad about 1,500 feet north of the shaft on the mineralized zone. In addition, an old but usable trail about a mile long led to the prospect from the elbow in Tracy Arm.

Twenty-seven channel samples moiled from open cuts and the shaft were spaced along more than 1,100 feet of the mineralized zone. Their copper values range from 0.02 to 5.7 percent and zinc values from 0.02 to 12.0 percent (table 27). A zone of generally banded

TABLE 27 NEAR HERE.

pyrrhotite, sphalerite and chalcopyrite from 0.5 to 3.5 feet thick is exposed in nearly all of 18 cuts along the more heavily mineralized 850-foot section of the zone.



Base from U.S. Geological Survey Bull. 998-A, Plate 1

Figure 65.-- Tracy Arm zinc-copper prospect, sample locations

Figure 65.--Tracy Arm zinc-copper prospect, sample locations.

Table 27.--Assay data, Tracy Arm zinc-copper prospect.

Sample	Pit No.	Type	Length Ft.	Length (m.)	Semiquantitative Spectrographic Analysis ppm Ag	Mo	Cd	Atomic Absorption ppm Au	Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
3K166	1	Channel	1.1	(0.3)	3	7	20	0.05	1400	150	3600	-	-	Gneiss and banded mineralization with quartz and pyrite.
3K167	2	do.	2.2	(.7)	.5	N	N		220		230	-	-	Gneiss with pyrite and chalcopyrite.
3K168	3	do.	0.5	(.2)	7	7	30	.15	12000	20	2800	-	-	Gneiss with banded sulfides.
3K174	4	do.	7.0	(2.1)	1	N	N	N	1600	10	1900	-	-	Gneiss.
3K175	5	do.	5.3	(1.6)	70	20	200	.30	20000	15	13000	-	-	Gneiss with sulfides.
3K176	6	do.	5.3	(1.6)	5	5	20	.05	5900	20	3600	-	-	
3K177	7	do.	6.8	(2.1)	5	5	50	.20	8900	25	8200	-	-	Gneiss and banded sulfides.
3K179	8	do.	4.3	(1.3)	5	10	150	.20	12000	25	23000	-	-	Gneiss with sulfides.
3K180	8	do.	4.2	(1.3)	3	5	30	N	3500	20	5800	-	-	do.
3K181	9	do.	5.8	(1.8)	50	10	100	.60	19000	20	17000	L	13.0	do.
3K182	10	do.	2.9	(.9)	30	10	150	.80	20000	15	33000	L	24.0	Gneiss and banded mineralization; ~~massive and disseminated sulfides.~~
3K183	11	do.	2.1	(.6)	70	10	150	2.5	23000	30	21000	0.7	13.0	Schist with banded ~~and massive~~ sulfides ~~sulfides.~~
3K184	12	do.	2.9	(.9)	100	10	500	1.5	57000	20	120000	.7	54.2	Massive pyrrhotite, chalcopyrite and sphalerite.
3K185	12	do.	3.0	(.9)	50	7	200	.40	17000	20	45000	N	13.7	do.
3P135	13	do.	4.0	(1.2)	10	7	500	.40	21000	10	9000	.3	19.2	Gneiss and banded mineralization with ~~with massive sulfides~~, pyrite, chalcopyrite and sphalerite.
3P136	14	do.	3.8	(1.2)	15	15	300	.40	24000	10	68000	.3	21.9	Gneiss and banded mineralization with pyrite.
3P137	15	do.	3.8	(1.2)	10	10	300	.15	13000	10	68000	0.3	10.0	Banded ~~Massive~~ sulfide zone.
3P138	16	do.	3.6	(1.1)	10	7	250	.15	9700	15	60000	-	-	do.
3P139	17	do.	4.3	(1.3)	15	10	300	.15	9000	15	27000	-	-	Gneiss and banded mineralization with pyrite, chalcopyrite, sphalerite.
3P140	17	do.	3.9	(1.2)	2	7	150	0.30	18000	20	43000	1.0	17.1	Alaskite and schist with ~~massive~~ banded and disseminated pyrite, chalcopyrite, sphalerite.
3P141	17	do.	1.6	(.5)	15	20	200	N	3400	15	20000	-	-	Gneiss and banded sulfides.

Table 27.--Assay data, Tracy Arm zinc-copper prospect, continued.

Sample	Pit No.	Type	Length Ft.	Length (m.)	Semiquantitative Spectrographic Analysis ppm Ag	Mo	Cd	Atomic Absorption ppm Au	Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
3P142	17	Channel	2.1	(.6)	20	5	100	.50	13000	25	33000	L	10.6	Gneiss and banded mineralization with pyrite, chalcopyrite and sphalerite.
3P143	18	do.	9.0	(2.7)	20	15	100	.10	17000	20	17000	-	-	Gneiss with pyrrhotite, pyrite, chalcopyrite, sphalerite.
3P144	19	do.	10.1	(3.1)	3	10	200	.15	8000	30	32000	-	-	Gneiss and banded mineralization with pyrrhotite, pyrite, chalcopyrite and sphalerite.
3P145	20	do.	6.5	(2.0)	5	15	200	.50	15000	25	30000	N	N	Banded ~~and massive~~ sulfides.
3P146	21	do.	2.9	(.9)	3	20	150	.25		20	-	-	-	do.
3P147	22	do.	2.7	(.8)	5	15	70	1.00		30	-	-	-	Gneiss and banded mineralization.

A 300-foot section of the 1,100 feet sampled appears to have the highest assay values. Channel samples from the shaft and 17 open cuts assayed 1.42 percent copper, 3.42 percent zinc, 0.43 ounces silver per ton and 0.008 ounces gold per ton across a 5.2-foot average width. At February 1976 prices, this ore would have a combined metal value of about $44 per ton. Using the convention of depth equal to one-half the strike length and the reasonable assumption that grade and width persist along strike for 850 feet and down dip for 425 feet, approximately 187,000 tons are inferred if a 10 cubic feet per ton volume-weight ratio is used.

This deposit, as presently known, is approaching minability at 1976 metal prices; it is estimated to have gross in-place value between $1 million and $10 million.

Magnetometer reconnaissance during the present study indicated no response that would be useful in further delineating the mineralized zone. Geochemical sampling (Race, 1962) along the projected strike of the mineralized zone suggests that the deposit may extend several hundred feet farther south than is indicated by the exposures in the open cuts, and also that the deposit could be detected geochemically only from within a few hundred feet.

5. Sumdum Glacier mineral belt between the Tracy Arm zinc-copper prospect and the Sumdum copper-zinc prospect

Between the Sumdum copper-zinc prospect and the Tracy Arm zinc-copper prospect there are zones of gneiss that are stained a prominent red and yellow. Those zones, as much as 0.4 miles wide, follow outcrop foliation and can be traced for great distances. The stained zones and areas between them were examined for mineralization.

Samples of rocks in the stained zones contain more disseminated pyrrhotite than the surrounding country rock. The staining is believed to be due to weathering of pyrrhotite to geothite and "limonite." No concentrations of other sulfides were noted during examination of these stained zones. Petrographic examination of rock specimens from those zones revealed traces of sphalerite and chalcopyrite.

Most of the 54 samples taken in this area were spaced-chip samples across the structure and ranged in length from 8 feet to 180 feet. Figures 64 and 66 show the area and sample locations, and table 28 gives

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Figure 66 and table 28 near here.

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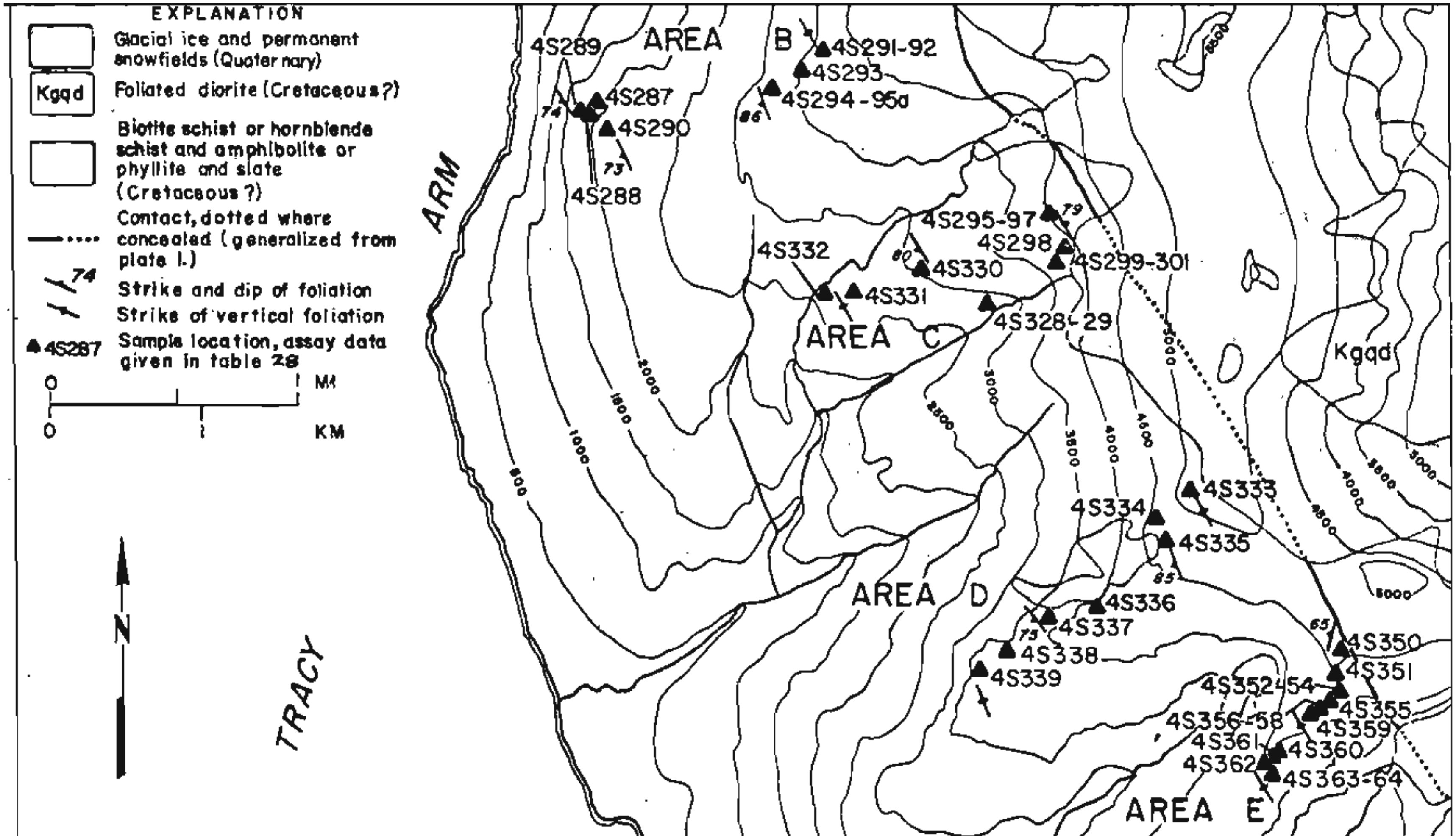
the assay results. A few sample results were slightly anomalous; copper reached a maximum of 290 ppm, zinc 250 ppm, and lead 230 ppm. Twelve of the samples contained 0.5-1 ppm silver. Two samples contained significant mineralization; one (4S364), an 0.8-foot channel sample of a quartz vein that assayed 30 ppm silver taken in area E, and the other, an 8-foot spaced chip sample (4S334) of iron-stained gneiss containing disseminated sulfides that assayed 0.10 ppm gold taken in area D. Based on our examination of the stained zones, it appears that the Sumdum copper-zinc prospect mineralization does not extend north to the Tracy Arm zinc-copper prospect.

6. Sumdum copper-zinc prospect

The Sumdum copper-zinc prospect was discovered by the Alaska Helicopter Syndicate in August 1958. Sixty-two lode claims were located in 1958 and 1959. Geologic mapping, sampling and diamond drilling programs were conducted largely during the 1959 season. MacKevett and Blake (1964) investigated the deposits in 1960, and much of the information presented here is derived from their work and from unpublished data gathered in 1958 and 1959 by the owners of the prospect (written commun., Cities Service Minerals Corporation, 1974).



Base from U.S.Geological Survey 1:63,360 Sumdum D-5 1955

Figure 66.-- Sumdum Glacier mineral belt between Sumdum copper-zinc prospect and Tracy Arm, areas B through E, sample locations

Figure 66.--Sumdum Glacier mineral belt between Sumdum copper-zinc prospect and Tracy Arm, localities B through E, sample locations.

Glacier

Table 28.--Assay data, Sumdum mineral belt between Sumdum Copper-zinc prospect and Tracy Arm.

Sample	Type	Length		Semiquantitative Spectrographic Analysis ppm		Atomic Absorption ppm			Description
		Ft.	(m.)	Ag	Mo	Cu	Pb	Zn	
					Area A				
4S302	Spaced chip, 2-ft. interval	30	(9.1)	0.5	N	30	60	130	Iron-stained gneiss.
4S303	do.	26	(7.9)	N	N	L	10	30	do.
4S304	Spaced chip, 0.5-ft. interval	11	(3.4)	2.0	N	30	35	60	do.
4S313	Spaced chip, 1-ft. interval	11.5	(3.5)	N	N	5	10	70	Altered granite in fault zone.
4S314	Spaced chip, 2-ft. interval	85	(25.9)	N	N	85	5	170	Iron-stained gneiss.
4S315	Spaced chip, 1-ft. interval	32	(9.8)	N	N	75	10	60	do.
4S316	do.	19	(5.8)	N	15	95	10	60	do.
4S317	Spaced chip, 0.125-ft. interval	12	(3.7)	N	N	170	L	10	Gneiss with veins.
4S318	Spaced chip, 2-ft. interval	60	(10.2)	N	N	80	5	10	Iron-stained gneiss.
4S319	Spaced chip, 1-ft. interval	21	(6.4)	N	N	85	5	50	do.
4S320	do.	19	(5.8)	N	N	85	5	10	do.
					Area B				
4S287	Channel	10.0	(3.0)	1	10	35	15	160	Iron-stained gneiss.
4S288	Spaced chip, 0.25-ft. interval	6	(1.8)	.5	15	50	15	250	do.
4S289	Spaced chip, 0.5-ft. interval	27	(8.2)	N	5	35	15	120	do.
4S290	Spaced chip, 0.5-ft. interval	15	(4.6)	N	5	40	30	170	Iron-stained gneiss.
4S291	Spaced chip, 2-ft. interval	15	(4.6)	N	N	60	10	30	do.

Table 28.--Assay data, Sumdum Glacier mineral belt between Sumdum Copper-zinc prospect and Tracy Arm, continued.

Sample	Type	Length Ft.	Length (m.)	Semiquantitative Spectrographic Analysis ppm Ag	Mo	Atomic Absorption ppm Cu	Pb	Zn	Description
				Area B cont.					
4S292	Spaced chip, 0.25-ft. interval	13	(4.0)	N	L	35	5	25	Iron-stained gneiss.
4S293	Spaced chip, 0.5-ft. interval	8	(2.4)	0.5	7	25	10	85	Silicified phyllitic schist.
4S294	Spaced chip, 2-ft. interval	180	(54.9)	1.5	N	55	5	45	Iron-stained schist.
4S295a	Spaced chip, 2-ft. interval	150	(45.7)	N	N	40	L	30	Iron-stained schist.
				Area C					
4S295	Continuous chip	13	(4.0)	N	N	90	5	50	Silicified schist with sulfides.
4S296	Spaced chip,	130	(39.6)	L	N	50	N	10	Iron-stained schist.
4S297	do.	90	(27.4)	L	N	35	L	20	do.
4S298	Selected grab	-	-	L	N	290	L	35	Iron-stained gneiss.
4S299	do.	-	-	L	N	150	5	15	do.
4S300	Spaced chip, 1-ft. interval	75	(22.9)	L	N	120	10	20	do.
4S301	do.	75	(22.9)	L	N	60	10	20	do.
4S328	Spaced chip, 2-ft. interval	75	(22.9)	0.5	10	130	5	30	do.
4S329	do.	75	(22.9)	.5	10	160	5	15	do.
4S330	Spaced chip, 0.5-ft. interval	20	(6.1)	1	10	20	10	55	Iron-stained gneiss.
4S331	Spaced chip, 1-ft. interval	27	(8.2)	.5	N	60	10	50	Iron-stained schist.
4S332	Spaced chip, 0.5-ft. interval	7	(2.1)	1	5	40	75	40	do.

Table 28.--Assay data, Sumdum Glacier mineral belt between Sumdum Copper-zinc prospect and Tracy Arm, continued.

Sample	Type	Length Ft.	Length (m.)	Semiquantitative Spectrographic Analysis ppm Ag	Semiquantitative Spectrographic Analysis ppm Mo	Atomic Absorption ppm Cu	Atomic Absorption ppm Pb	Atomic Absorption ppm Zn	Description
					Area D				
4S333	Spaced chip, 2-ft. interval	20	(6.1)	L	N	15	5	40	Gneiss with disseminated sulfides.
4S334 1/	Spaced chip, 1-ft. interval	8	(2.4)	L	N	55	5	95	Gneiss.
4S335	do.	26	(7.9)	0.5	N	15	5	35	do.
4S336	do.	23	(7.0)	L	N	25	10	45	Iron-stained gneiss.
4S337	do.	12	(3.7)	1	20	75	5	230	do.
4S338	Channel	.7	(.2)	N	N	20	N	5	Quartz vein.
4S339	Spaced chip, 1-ft. interval	71	(21.6)	L	N	70	15	85	Iron-stained schist.
					Area E				
4S350 2/	Spaced chip, 0.5-ft. interval	12	(3.7)	N	30	25	5	250	Iron-stained schist.
4S351	Spaced chip, 1-ft. interval	18.6	(5.7)	N	N	40	10	55	do.
4S352	do.	10	(3.0)	N	N	60	5	25	do.
4S353	Spaced chip, 1-ft. interval	60	(18.3)	N	N	80	L	25	Iron-stained gneiss.
4S354	do.	38	(11.6)	N	N	15	L	25	Iron-stained phyllite.
4S355 2/	Spaced chip, 0.5-ft. interval	-	-	N	N	85	10	160	do.
4S356	Spaced chip, 1-ft. interval	35	(10.7)	N	N	35	L	20	do.
4S357	do.	15	(4.6)	N	30	50	5	20	do.
4S358	do.	50	(15.2)	N	N	45	5	30	do.
4S359	Spaced chip, 0.5-ft. interval	8.4	(2.6)	N	N	45	L	45	Iron-stained schist.
4S360	Spaced chip, 1-ft. interval	26	(7.9)	N	N	15	40	40	do.

1/ Atomic absorption gave 0.10 ppm Au
2/ Atomic absorption gave L for Au

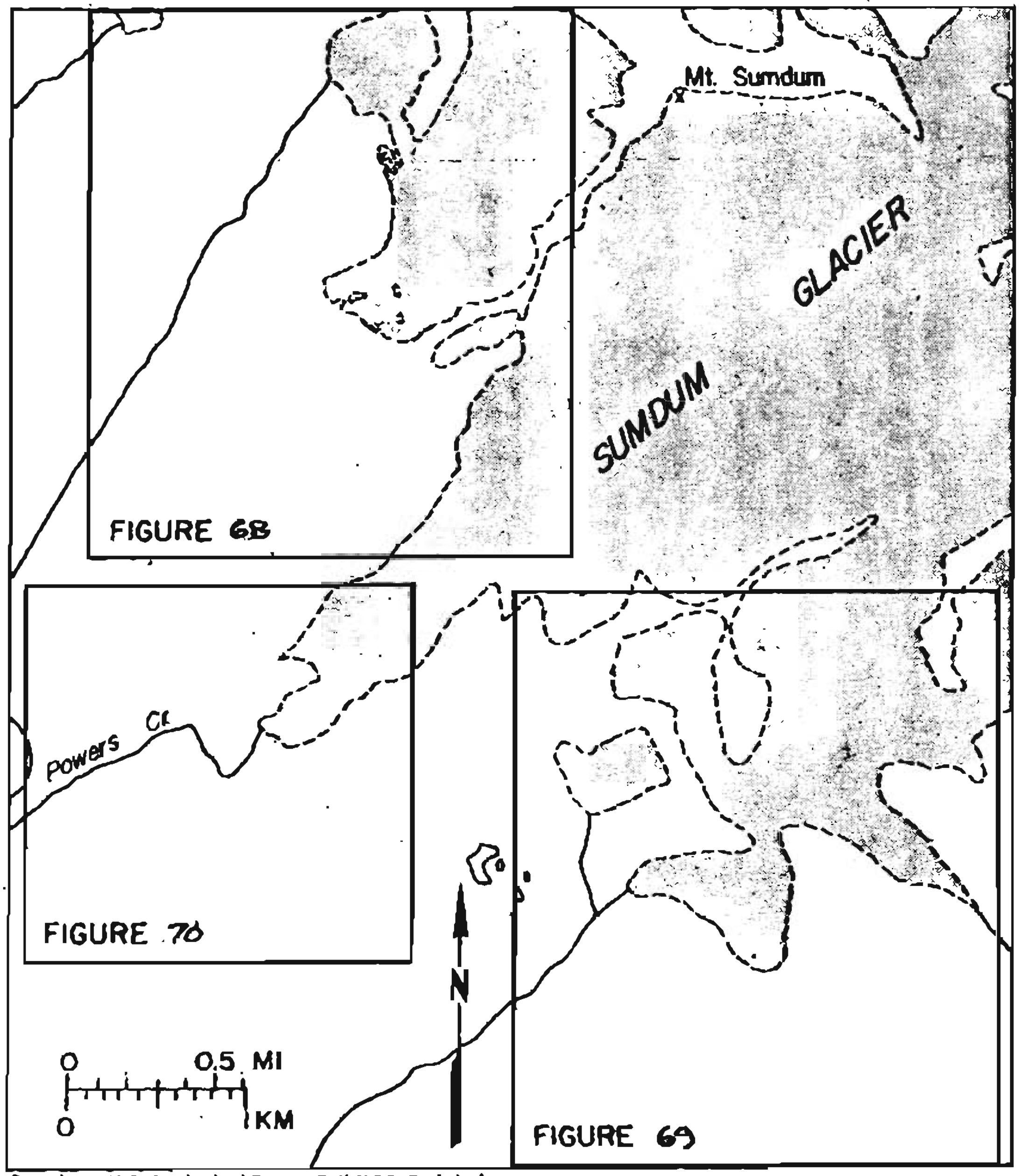
Table 28.--Assay data, Sumdum Glacier mineral belt between Sumdum Copper-zinc prospect and Tracy Arm, continued.

Sample	Type	Length		Semiquantitative Spectrographic Analysis ppm		Atomic Absorption ppm			Description
		Ft.	(m.)	Ag	Mo	Cu	Pb	Zn	
					Area E cont.				
4S361	Spaced chip, 1-ft. interval	31	(9.4)	N	N	5	5	30	Iron-stained schist.
4S362	do.	19	(5.8)	N	N	5	5	25	do.
4S363	do.	31	(9.4)	0.5	N	5	10	45	do.
4S364	Channel	.8	(0.2)	30	N	L	230	45	

Disseminated and locally massive pyrrhotite and pyrite bodies containing chalcopyrite and sphalerite with small amounts of bornite, chalcocite, malachite, azurite, and galena occur in steeply dipping northwest striking zones from one to 50 feet thick. Such zones have been found on either side of the mile-wide Sumdum Glacier and those zones on the southeast side of the Glacier appear to align with those on the northwest side. The mineralized zones are not continuously exposed but are visible in cliffs and in surface trenches. They are otherwise covered with snow, ice and rock rubble. They have been partially explored by 14 diamond drill holes totalling 5,400 feet, about half on either side of the glacier. Evidence from diamond drilling in conjunction with surface trenches and cliff exposures indicates that copper and zinc mineralization could extend along strike for 10,000 feet or more assuming continuity exists beneath the Sumdum Glacier.

Figures 67, 68 and 69 near here.

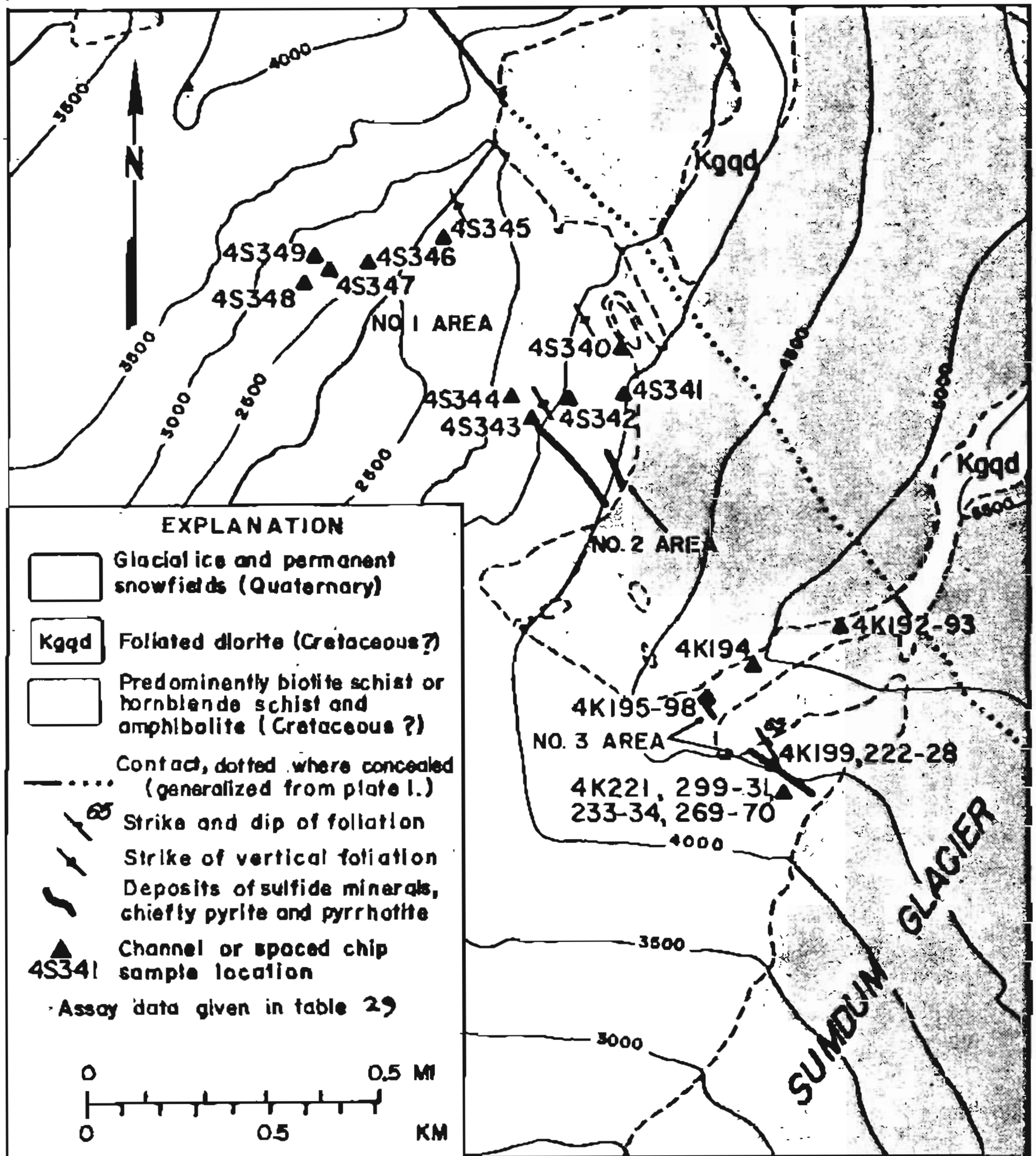
Diamond drill hole intercepts give a three-dimensional picture of a large nearly isoclinal anticlinal fold that widens downward. Apparently continuous mineralization in a selective horizon or horizons is thickest in the fold crest and tends to thin down the limbs.



Base from U.S. Geological Survey Bull. 1108-E plate 1

Figure 67.- Index map for Sumdum copper-zinc prospect

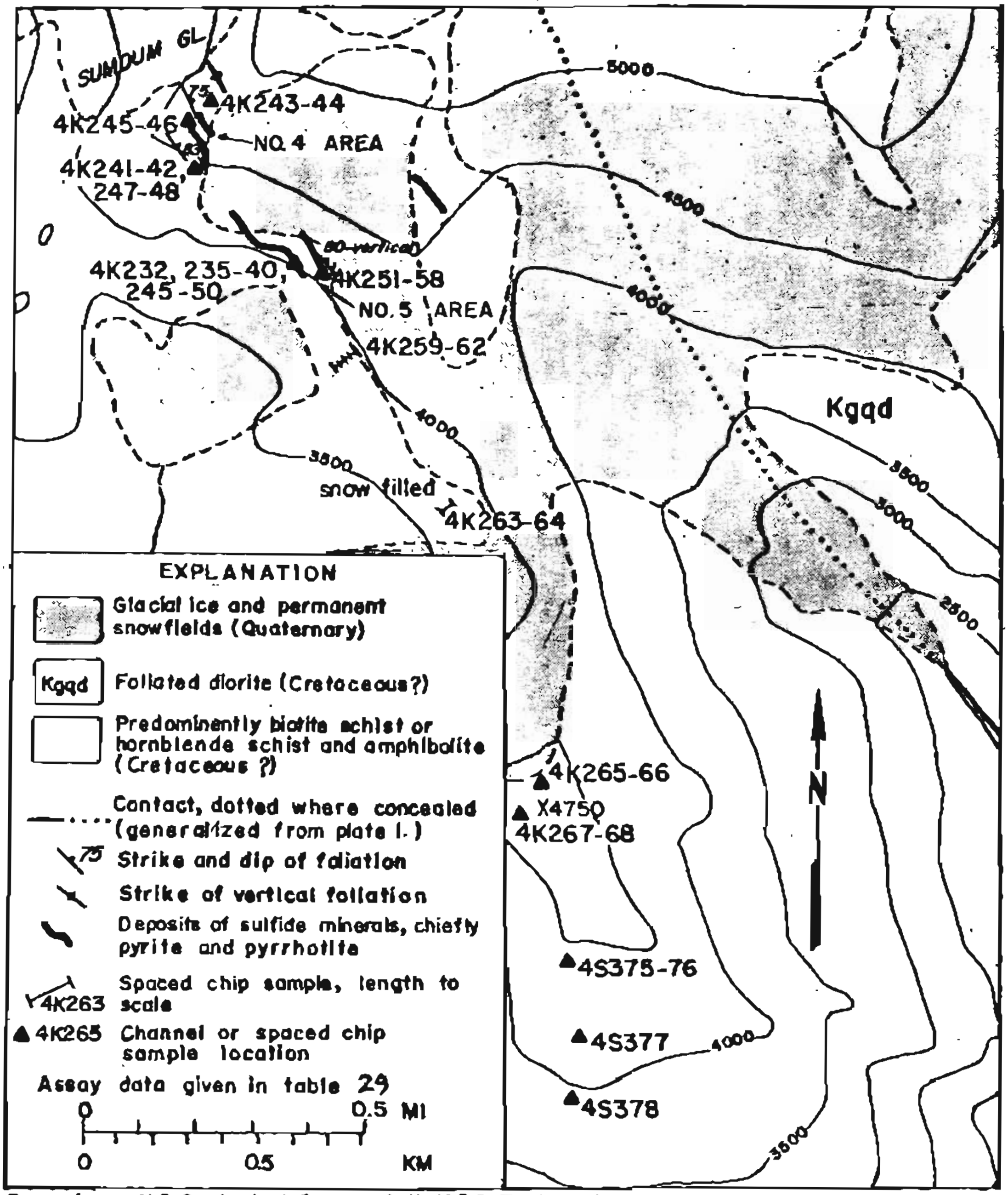
Figure 67.--Index map for Sumdum copper-zinc prospect.



Base from U.S. Geological Survey Bull. 1108-E, plate I.

Figure 68.--Sumdum copper-zinc prospect, north section, sample locations

Figure 68.--Sumdum copper-zinc prospect, north section, sample locations.



Base from US Geological Survey Bull. 1108-E, plate I.

Figure 69 Sumdum copper-zinc prospect, south section, sample locations

Figure 69.--Sumdum copper-zinc prospect, south section, sample locations.

Mineralized intercepts in diamond drill holes vary from more than 50 feet to less than 10 feet with the wider sections being nearer the fold crest generally. Copper assay values vary from almost nil to more than 1.5 percent copper and generally lie between 0.5 percent and 1.0 percent. Although zinc is present the assays are lower than those for copper. Silver values average about 0.25 ounces/ton.

Host rocks are interlayered biotite-quartz-plagioclase and hornblende-plagioclase gneisses of the biotite schist map unit which have been isoclinally folded and are characterized by numerous minor folds on the larger fold limbs. Some potential ore bodies are localized along the crests of these minor folds on the limbs of a large, nearly isoclinal anticline, thus accounting for two sub-parallel mineralized zones in most areas which were drilled and surface sampled. Bodies in area #3 north of the glacier (fig. 68) follow brecciated fault zones and also comprise two sub-parallel zones, suggesting they are part of the same or a parallel fold structure.

Although the continuity of mineralized structure across the glacier cannot be clearly proven, it is suggested by the alignment of the structure and presence of twin zones on either side of the mile-wide glacier. There are, however, no reasonable drill sites from which the continuity of this structure under the Sumdum Glacier could be simply tested.

Exploration by the owners in 1958 and 1959, in addition to 5,400 feet of diamond drilling, included 300 feet of open cuts that were channel sampled in areas along the zone or zones of exposed mineralization both north and south of the glacier. Sampled sections in both diamond drill core and in open cuts were 10 feet or less. More than 200 sampled sections of core and about 50 channel samples from the open cuts were assayed for copper. In addition, zinc, gold, and silver were run on longer sections which were weight-ratio composited into single assay samples.

During the present study snow cover was considerably more extensive than 15 years before, for all drill sites and most open cuts sampled by the owners in the late 1950's were concealed by snow throughout our investigation. Those open cuts which were exposed during our study were channel sampled. Spaced-chip samples were also obtained across other measured sections where rocks appeared particularly iron-stained. The latter were obtained from some of the few rock exposures that were accessible for sampling, and are not necessarily precisely along projected trends of the mineralized structure (table 29, figs. 68 and 69).

Table 29 near here.

Table 29.--Assay data, Sumdum copper-zinc prospect.

Sample	Type	Length Ft.	Length (m.)	Semiquantitative Spectrographic Analysis ppm Ag	Mo	Atomic Absorption ppm Au	Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
						No. 1 area						
4S345	Spaced chip, 1-ft. interval	50	(15.2)	N	N	N	35	L	50	-	-	Iron-stained gneiss with disseminated sulfides.
4S346	do.	39	(11.9)	N	N	0.05	40	5	50	-	-	do.
4S347	Chip	12.0	(3.7)	7	20	N	15	180	40	-	-	Quartz vein.
4S348	Spaced chip, 1-ft. interval	54	(16.5)	L	N	N	35	15	60	-	-	Iron-stained gneiss with disseminated sulfides.
4S349	do.	54	(16.5)	7	30	L	70	750	1500	-	-	do.
						No. 2 area						
4S340	Spaced chip, 0.5-ft. interval	14	(4.3)	N	N	N	85	L	30	-	-	Iron-stained gneiss.
4S341	Chip	5.6	(1.7)	3	N	.10	8100	40	110	-	-	Massive sulfide vein.
4S342	Spaced chip, 1-ft. interval	50	(15.2)	.5	20	N	90	5	65	-	-	Iron-stained gneiss.
4S343	do.	22	(6.7)	L	N	N	85	10	40	-	-	do.
4S344	Spaced chip, 0.5-ft. interval	14	(4.3)	L	30	N	85	5	50	-	-	do.
						No. 3 area						
4K192	Spaced chip, 1-ft. interval	75	(22.9)	.7	N	N	30	10	60	-	-	Hornfels. } continuous section
4K193	do.	75	(22.9)	L	N	N	25	10	90	-	-	do. } continuous section
4K194	do.	50	(15.2)	N	N	N	20	L	15	-	-	Dark schist with disseminated pyrite.
4K195	Selected grab	-	-	1.5	N	N	680	95	1300	-	-	Gneiss with pyrrhotite.
4K196	do.	-	-	10	N	N	870	1100	410	-	-	Gossan.
4K197	Spaced chip, 1-ft. interval	60	(18.3)	2	N	N	150	320	180	-	-	Gneiss. } continuous section
4K198	do.	55	(16.8)	3	N	N	290	400	370	-	-	do. } continuous section

Table 29.--Assay data, Sumdum copper-zinc prospect, continued.

Sample	Type	Length Ft.	Length (m.)	Semiquantitative Spectrographic Analysis ppm Ag	Mo	Atomic Absorption ppm Au	Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
						No. 3 area-continued						
4K199	Channel	0.8	(0.2)	7	N	.10	7000	310	65000	N	11.3	Pyrrhotite and chalcopyrite.
4K221	do.	3.0	(.9)	10	N	.05	12000	25	2500	N	17.2	Massive phyrrhotite with chalcopyrite and sphalerite.
4K222	do.	1.8	(0.5)	10	30	.10	2300	90	1400	-	-	Hanging wall of pyrrhotite zone.
4K223	do.	0.4	(0.1)	15	N	.10	5900	65	42000	-	-	Pyrrhotite zone.
4K224	do.	1.2	(0.4)	15	30	N	2300	2400	38000	-	-	Gossan.
4K225	Spaced chip, 1-ft. interval	30	(9.1)	5	N	N	750	40	430	-	-	Gneiss and gossan
4K226	Channel	2.9	(0.9)	10	N	.10	2700	25	390	-	-	Gossan.
4K227	do.	0.9	(0.3)	5	N	N	500	85	400	-	-	Gneiss.
4K228	Spaced chip, 1-ft. interval	28	(8.5)	3	30	L	700	40	180	-	-	Gossan breccia zone.
4K229	Channel	1.7	(0.5)	2	10	N	5100	20	3500	-	-	Sulfide zone.
4K230	Spaced chip, 0.5-ft. interval	68	(20.7)	2	7	N	280	20	120	-	-	Gneiss
4K231	do.	72	(21.9)	L	N	N	95	20	30	-	-	Schist and gneiss.
4K233	Chip	2.3	(0.7)	2	L	N	400	50	280	-	-	Gneiss.
4K234	do.	3.7	(1.1)	3	L	N	650	30	180	-	-	do.
4K269	Composite grab	-	-	7	N	1.5	900	330	150	-	-	Gossan breccia.
4K270	Channel	6.1	(1.9)	15	N	L	7200	25	5200	-	-	Pyrrhotite with chalcopyrite and sphalerite.
						No. 4 area						
4K241	Chip	6.8	(2.1)	N	N	N	50	L	25	-	-	Gneiss, minor pyrrhotite.
4K242	do.	17.4	(5.3)	N	N	N	140	10	60	-	-	Gneiss.
4K243	Spaced chip, 1-ft. interval	28	(8.5)	N	N	N	25	L	50	-	-	Iron-stained gneiss.
4K244	Spaced chip, 0.5-ft. interval	10	(3.0)	N	N	N	20	L	55	-	-	do.
4K245	Selected grab	-	-	N	N	N	50	L	50	-	-	Rusty quartzite.
4K246	Spaced chip, 0.5-ft. interval	25	(7.6)	N	N	N	45	L	30	-	-	Iron-stained zone.
4K247	do.	16	(4.9)	N	N	N	45	L	45	-	-	Gneiss.
4K248	do.	17	(5.2)	N	N	N	40	10	50	-	-	do.

Table 29.--Assay data, Sumdum copper-zinc prospect, continued.

Sample	Type	Length Ft.	(m.)	Semiquantitative Spectrographic Analysis ppm Ag	Mo	Atomic Absorption ppm Au	Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description	
						No. 5 area							
4K234	Chip	3.7	(1.1)	3	L	N	650	30	180	-	-	Gneiss	
4K232	Spaced chip, 0.5-ft. interval	50	(15.2)	3	N	.15	260	20	630	-	-	do.	
4K235	Channel	10.0	(3.0)	10	N	1.5	7800	900	21000	N	22.6	Gneiss with pyrrhotite, chalcopyrite and sphalerite.	continuous section
4K236	do.	10.0	(3.0)	2	N	.10	710	35	280	-	-	Gneiss with pyrrhotite.	
4K237	do.	10.0	(3.0)	0.7	N	L	650	35	120	-	-	Crenulated	
4K238	do.	10.0	(3.0)	1	N	.10	1000	15	80	-	-	do.	
4K239	do.	6.2	(1.9)	2	N	.10	3600	15	150	-	-	do.	
4K240	Spaced chip, 1-ft. interval	50	(15.2)	0.5	N	L	300	15	100	-	-	Gneiss	
4K249	Channel	10.0	(3.0)	5	N	0.15	1000	130	4200	N	10.3	Pyrite pod.	continuous section
4K250	do.	5.0	(1.5)	3	N	.05	980	210	310	-	-	Gneiss	
4K251	do.	10.0	(3.0)	7	N	.30	3500	150	5400	-	-	Gneiss with pyrrhotite, chalcopyrite and sphalerite zone.	continuous section
4K252	do.	10.0	(3.0)	15	N	.10	5000	790	22000	-	-	do.	
4K253	do.	10.0	(3.0)	10	N	.10	4400	660	8100	-	-	do.	
4K254	do.	10.0	(3.0)	15	N	.10	6800	360	6600	-	-	do.	
4k255	do.	10.0	(3.0)	15	7	.55	2600	320	1500	-	-	do.	
4K256	Spaced chip, 0.5-ft. interval	40	(12.2)	20	N	.25	900	400	850	.7	8.9	Rusty gneiss with pyrite pods.	
4K257	Spaced chip, 1-ft. interval	40	(12.2)	2	N	.05	600	30	180	-	-	do.	
4K258	do.	45	(13.7)	10	N	.20	900	690	5200	-	-	do.	

Table 29.--Assay data, Sumdum copper-zinc prospect, continued.

Sample	Type	Length Ft.	Length (m.)	Semiquantitative Spectrographic Analysis ppm Ag	Semiquantitative Spectrographic Analysis ppm Mo	Atomic Absorption ppm Au	Atomic Absorption ppm Cu	Atomic Absorption ppm Pb	Atomic Absorption ppm Zn	Fire Assay ppm Au	Fire Assay ppm Ag	Description	
				Southeast of no. 5 area									
4K259	Spaced chip, 1-ft. interval	75	(22.9)	0.5	N	L	480	100	1800	-	-	Rusty schist and gneiss with minor sulfides. Projection of ore zone probably west under snow.	continuous section
4K260	do.	75	(22.9)	N	N	N	40	55	40	-	-	do.	
4K261	do.	75	(22.9)	N	N	N	50	L	35	-	-	do.	
4K262	do.	75	(22.9)	N	N	N	25	5	20	-	-	do.	continuous section
4K263	do.	70	(21.3)	N	N	N	35	5	65	-	-	Gneissic rocks with minor disseminated iron sulfides.	
4K264	do.	68	(20.7)	N	N	N	45	5	50	-	-	do.	
4K265	do.	24	(7.3)	N	N	N	160	5	20	-	-	Dark banded gneiss	continuous section
4K266	do.	43	(13.1)	N	N	N	95	L	15	-	-	do.	
4K267	do.	50	(15.2)	N	N	N	60	15	75	-	-	Rusty gneiss.	continuous section
4K268	do.	14	(4.3)	N	N	N	25	25	45	-	-	do.	
4S375	do.	65	(19.8)	N	N	N	35	20	70	-	-	Stained shist.	
4S376	do.	65	(19.8)	N	N	N	25	20	35	-	-	do.	
4S377	Spaced chip, 0.5-ft. interval	18	(5.5)	N	5	N	55	15	80	-	-	Stained schist with sulfides.	
4S378	do.	36	(11.0)	N	N	N	50	15	75	-	-	Stained schist with finely-disseminated sulfides.	

Two 50-foot open cuts on the edge of southwest-facing cliffs at the extreme south end of the two zones in area #5 were channel sampled; the assay results were very similar to results reported by the owners in 1959. Our samples from outcrops and open cuts in areas #2 and #3 also confirm generally the values reported by the owners in those areas. Spaced-chip samples were taken along measured lines normal to structure but not necessarily across the mineralized structure. Those taken south of area #2 to one-half mile south of area #5 generally contained above background amounts of copper, zinc and silver, and indicate geochemical trends in that these metals are present parallel to structure over a long distance. Most of those collected in and north of area #2 were not anomalous. Samples from the 4,750-foot peak and mountain shoulder a mile south of area #5 also were not anomalous. The latter, however, are not necessarily quite on trend with the mineralized structure. Also the mineralized structural horizons, if they extend that far south on the limbs of a suggested large anticlinal fold having a gentle southeastward axial plunge, would probably be buried there rather than being exposed. This area is within the claim boundaries.

Reserve calculations have been made by the Bureau of Mines based on diamond drill hole and surface trench assays furnished by the owners, using a standard modified polygonal system. The results of the calculations are summarized below; they represent only that part of the deposit that has been explored.

The mineralized zones exposed on both sides of the Sumdum Glacier align and apparently extend beneath the glacier. The mineralized zones that are best explored by diamond drilling are at areas #3 and #5 located on the north and south sides of the glacier. The north end of the drilled section of the mineralized zone at area #3 is separated by 9,000 feet from the south end of the drilled section of the mineralized zone at area #5. This 9,000 feet consists of 1,500 feet that is drilled, 6,000 feet that is covered by glacier, and 1,500 feet that is poorly exposed, with difficult access and is little explored. The 1,500-foot strike length (Areas #3 and #5) that is drilled contains 1,870,000 tons of indicated resources with an average width of 31.5 feet and an average grade (as estimated from assays) of 0.57 percent copper, 0.37 percent zinc, and 0.30 ounces per ton silver. If the mineralized zones display the same width and grade under the glacier as they do at areas #3 and #5 and if they extend down dip for 1,000 feet (1,000 feet of down dip mineralization is exposed) there is an inferred tonnage of 26,480,000. If this is combined with an additional inferred tonnage of 217,000 tons at area #2, the total inferred tonnage for the prospect is 26,700,000 with an average width of 31.4 feet and an average assay of 0.57 percent copper, 0.37 percent zinc and 0.30 ounces per ton silver.

The calculations also indicate that one part of this deposit contains about 211,000 tons of indicated ore averaging 1.18 percent copper, 0.15 percent zinc, and 0.25 oz/ton silver over a 12.7-foot width and 575-foot strike length to a depth of 540 feet, and another part has 217,500 tons of inferred ore containing 1.15 percent copper and 0.37 percent zinc over a 12.5-foot width and 600-foot strike length to a depth of 290 feet.

7. Powers Creek altered zone

Rusty siliceous schist is exposed at the head of Powers Creek 1/4 mile below the terminus of Sumdum Glacier (fig. 70); this recently

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Figure 70 near here.

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glaciated terrain is nearly devoid of soil and vegetation. One lode claim, the Eclipse, reportedly was located in this vicinity in 1902. The conspicuous color and proximity to the Sumdum copper-zinc prospect suggested the area was mineralized. During this study, 11 spaced chip samples (with 2-foot interval) were taken in a composite section 1,130 feet long approximately normal to strike of the schists. The analyses (table 30) show all 11 samples contained 0.5 to 1.0 ppm silver, 3 samples

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TABLE 30 NEAR HERE.

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15 to 30 ppm molybdenum, and two samples had values of 150 to 380 ppm zinc. The analyses indicated nothing else of significance. Small quantities of finely disseminated sulfides were seen in several places. Petrographic examination indicated this to be pyrrhotite although a trace of chalcopyrite was detected in one specimen. Sphalerite was not detected.

The country rocks in the area are siliceous, muscovite and chlorite schists that are somewhat graphitic and have numerous small folds and quartz lenses. Examination indicates these rocks, though highly iron-stained, are similar in metal content to unmineralized schists and gneisses of the area generally.

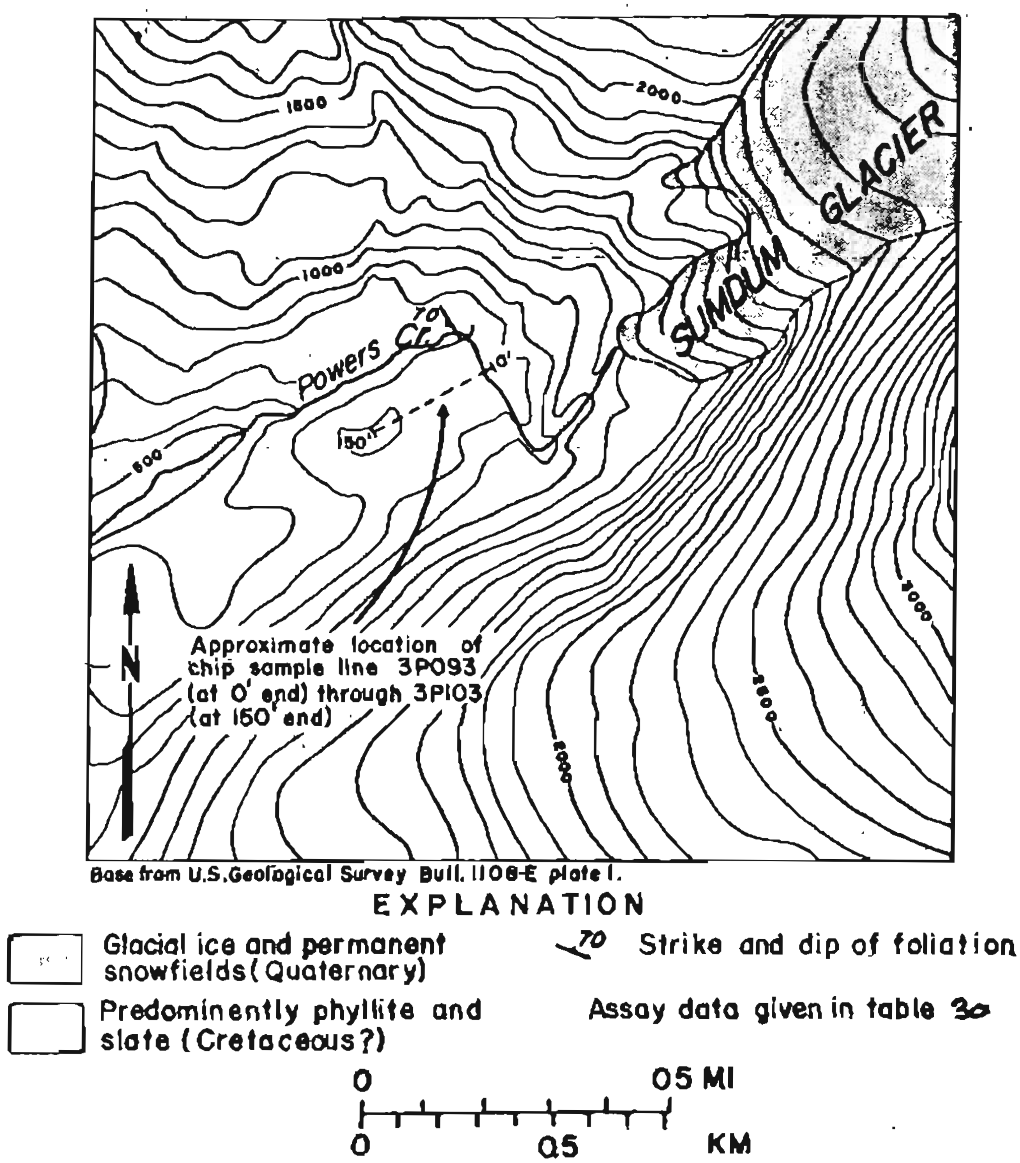


Figure 70.-- Powers Creek stained zone, sample locations

Figure 70.--Powers Creek stained zone, sample locations.

Table 30.--Assay data, Powers Creek stained zone.

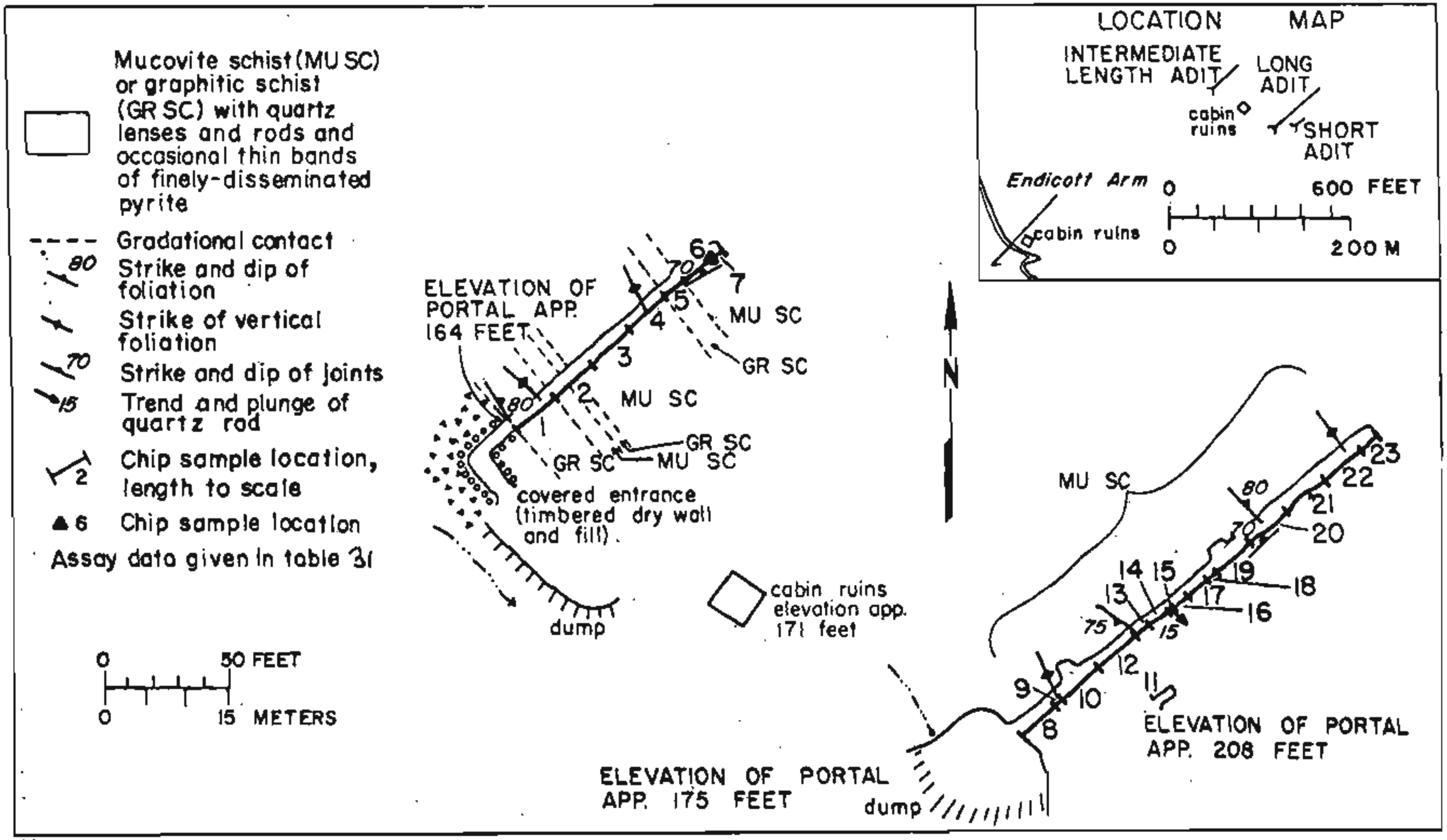
Sample	Type	Length		Semiquantitative Spectrographic Analysis ppm			Atomic Absorption ppm		Description
		Ft.	(m.)	Ag	Mo	Ba	Cu	Zn	
3P093	Spaced chip, 2-ft. interval	100	(30.5)	0.7	10	1500	65	150	Iron-stained siliceous phyllite with occasional disseminated pyrrhotite, traces of chalcopyrite and discontinuous quartz veins and pods.
3P094	do.	100	(30.5)	.5	30	2000	60	380	
3P095	do.	100	(30.5)	.5	15	1500	45	110	
3P096	do.	100	(30.5)	.5	10	1500	50	85	
3P097	do.	100	(30.5)	.7	15	1500	55	95	
3P098	do.	100	(30.5)	.7	7	1500	60	110	
3P099	do.	100	(30.5)	.5	5	1500	75	120	
3P100	do.	100	(30.5)	.7	7	1500	65	120	
3P101	do.	100	(30.5)	.5	7	1000	80	120	
3P102	do.	100	(30.5)	.5	10	1000	65	120	
3P103	do.	130	(39.6)	1.0	7	1500	80	80	

8. Portland prospect

The long inactive Portland gold prospect is situated about 300 yards from the northeast shore of Endicott Arm and about 175 feet above sea level. A well-built but overgrown trail joins the workings with cabin ruins near the beach. Development consists of 305 feet of workings in three adits probably driven between 1890 and 1910 (fig. 71). The adits

Figure 71 near here.

are driven normal to iron-stained, silicified muscovite schist and phyllite (of the phyllite and slate map unit) which contain numerous quartz stringers and lenses parallel to schistosity. Pyrite, pyrrhotite, and traces of galena, sphalerite and chalcopyrite occur as sparse disseminations and in occasional thin stringers parallel to foliation. Seven claims were located in 1889 and were relocated in 1897. Additional claims recorded during the next few years were reported in this vicinity but descriptions are vague and none, including the Portland group itself, could be identified on the ground. Spencer (1906) briefly discussed the property and reported a cross-cut tunnel. Two other cross-cuts probably were driven not long after that. Herreid and Race (1962) sampled and mapped the two larger cross-cuts. Information from their work has been incorporated into the figure and text of the present study.



Mapped by A.Kimball, T.L.Pittman and F.Smith, August 1972

Figure 71.-- Portland propect, sample locations

Figure 71.--Portland prospect, sample locations.

The only surface exposures in the area are so heavily overgrown and weathered as to preclude sampling them; however, the three cross-cuts present continuous exposures normal to the foliation. The analyses of 23 channel samples covering the full length of each of three cross-cuts 189, 109, and 7 feet in length are reported in table 31. A majority are

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TABLE 31 NEAR HERE.

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anomalous in one or more of the elements: gold, silver, copper, lead and zinc. The highest value for each of these elements was in a single 8-foot sample from the short cross-cut: 0.10 ppm gold, 10 ppm silver, with 930 ppm copper, 1,800 ppm lead and 3,400 ppm zinc. All the other values of interest were obtained in the long cross-cut 33 feet below the short one. One sample from the long cross-cut, the only other sample containing measurable gold (0.10 ppm) lies down dip from the gold value in the short cross-cut. The intermediate length cross-cut contained no significant gold or other metal values although it probably intersects the same structure.

Although generally considered a gold-silver prospect, the Portland prospect contains base metal values which suggest continuity with other base metal prospects along the Sumdum Glacier mineral belt.

Table 31.--Assay data, Portland prospect.

Sample		Type	Length Ft.	(m.)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption ppm Cu	Pb	Zn	Description
					Intermediate length adit				
11/	(2K156)	Chip	20.0	(6.1)	N	60	20	150	Black phyllitic schist.
2	(2K157)	do.	20.0	(6.1)	N	25	15	45	Muscovite schist.
3	(2K158)	do.	20.0	(6.1)	N	15	30	20	Muscovite schist with quartz.
4	(2K159)	do.	20.0	(6.1)	N	25	40	70	Phyllite with quartz.
5	(2K160)	do.	10.0	(3.0)	N	20	25	45	Quartz muscovite schist.
6	(2K162)	do.	.5	(.15)	N	10	35	10	Thin band of iron.
7	(2K161)	do.	19.0	(5.8)	N	10	10	10	do.
					Long adit				
8	(2K141)	Chip	18.0	(5.5)	0.7	35	60	120	Mica schist.
9	(2K142)	do.	4.0	(1.2)	N	10	25	15	Sericitic schist.
10	(2K143)	do.	20.0	(6.1)	N	20	20	75	Phyllitic schist.
12	(2K144)	do.	20.0	(6.1)	N	60	40	240	Phyllitic schist with chlorite.
13	(2K145)2/	do.	7.0	(2.1)	.5	40	55	150	do.
14	(2K146)	do.	11.0	(3.4)	N	70	20	180	Dark phyllitic schist.
15	(2K147)	do.	1.5	(.5)	N	30	35	30	Quartz rod
16	(2K148)	do.	6.5	(2.0)	N	60	20	250	Dark phyllitic schist with muscovite.
17	(2K149)	do.	11.0	(3.4)	L	45	85	360	Quartz mica schist.
18	(2K150)	do.	4.0	(1.2)	N	60	65	310	Dark quartz phyllitic schist.
19	(2K151)	do.	23.0	(7.0)	2	300	460	950	Quartz schist.
20	(2K152)	do.	20.0	(6.1)	N	20	95	55	Quartz muscovite schist.
21	(2K153)	do.	20.0	(6.1)	1	35	400	270	Schist with quartz.
22	(2K154)	do.	20.0	(6.1)	N	45	170	25	do.
23	(2K155)	do.	9.0	(2.7)	L	25	200	60	Quartz muscovite schist.
					Short adit				
11	(2K163)3/	Chip	8.0	(2.4)	10	930	1800	3400	Thin band of iron.

1/ Refer to figure _

2/ Atomic absorption gave 0.10 ppm Au.

3/ Atomic absorption gave 0.10 ppm Au.

Table 31.--Assay data, Portland prospect, continued.

Sample	Type	Length Ft.	Length (m.)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption ppm Cu	Atomic Absorption ppm Pb	Atomic Absorption ppm Zn	Description
				Portland extension				
2K164	Spaced chip, 1-ft. interval	24	(7.3)	N	35	30	35	Siliceous calc-breccia.
2K165		23	(7.0)	N	20	25	35	do.
2K166	Spaced chip, 5-ft. interval	40	(12.2)	N	40	45	55	Graphitic calc-schist.
2K167	do.	100	(30.5)	N	25	30	25	Calc-schist.

Iron-stained rocks that occur in a prominent cove 2-1/2 miles southeast of the Portland workings were also sampled (table 31), but are probably east of the Portland prospect structure. They consist of quartz-ankerite breccia associated with calcareous graphite schist. Although traces of chalcopyrite were detected in some specimens, assays show very low copper values. One sample contained 100 ppm lead, the only anomalous value reported in this group of four samples. This area may be the area referred to as the Portland extension.

9. Bushy Islands copper anomaly

Copper stains and traces of chalcopyrite in quartz stringers in phyllite occur on a wave cut bench just below tide line at the north end of the Bushy Islands in Endicott Arm (fig. 72).

Figure 72 near here.

A chip sample was cut across 5.2 feet of the phyllite where slightly copper-stained quartz stringers were most evident. These quartz stringers, 0.05 to 1.5 feet wide, locally contain traces of chalcopyrite, sphalerite, and malachite. They generally parallel the foliation. Analyses indicated 700 ppm copper and 1,600 ppm zinc, and 0.015 ounces silver per ton. Other metal values are insignificant. Search of the limited bedrock beach, the only good rock exposure in the vicinity, revealed no additional evidence of copper mineralization.

Sulfide stringers in biotite schist 0.6 mile to the southwest on the northeast shore of Sumdum Island were sampled. Samples were cut in three increments along a 27.9-foot section across foliation of the schists which contain subparallel quartz stringers with bands of marcasite and pyrite along the schistosity. The central sample of the three, 11.8 feet long, assayed 140 ppm zinc and 15 ppm molybdenum. Other values obtained from the three samples were of less interest. A fourth sample, a composite of multiple cuts from a 0.1 to 0.5-foot wide sulfide-bearing quartz vein, gave values of 80 ppm lead and 160 ppm zinc. Both of these localities are within the Sumdum Glacier mineral belt but are well isolated due to their island location.

10. Sulphide prospect

The Sulphide group, an active zinc-lead-silver prospect, is located nine miles below Sanford Cove on the southwest side of Endicott Arm. The prospect consists of poorly defined bands of disseminated sulfides roughly parallel to the foliation in gneiss and quartzite. Four shallow open cuts along the strike expose an aggregate of 130 feet of mineralization. Projected between cuts, the mineralization crudely defines a single zone with a length of about 830 feet (fig. 73). A

Figure 73 near here.

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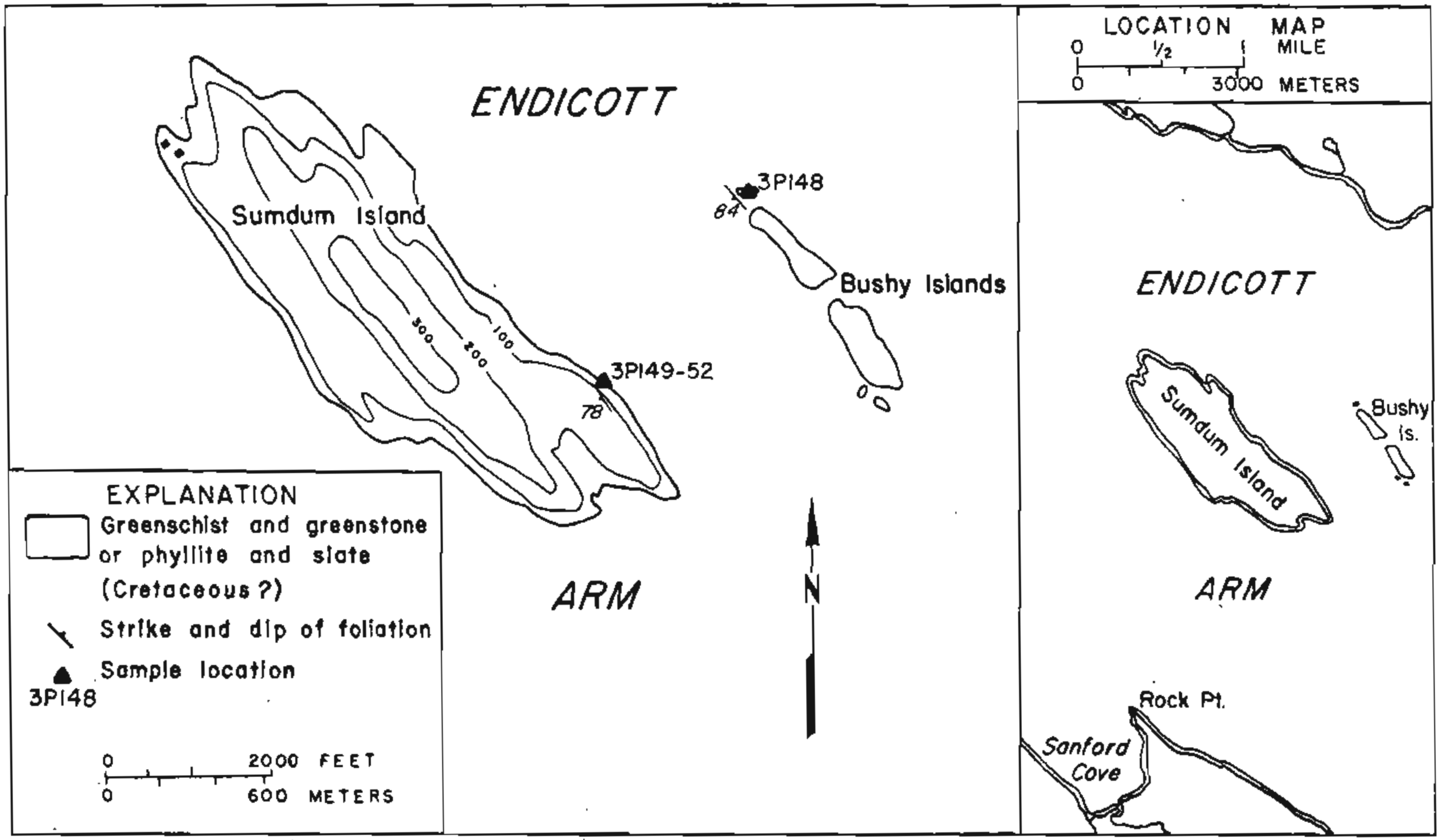
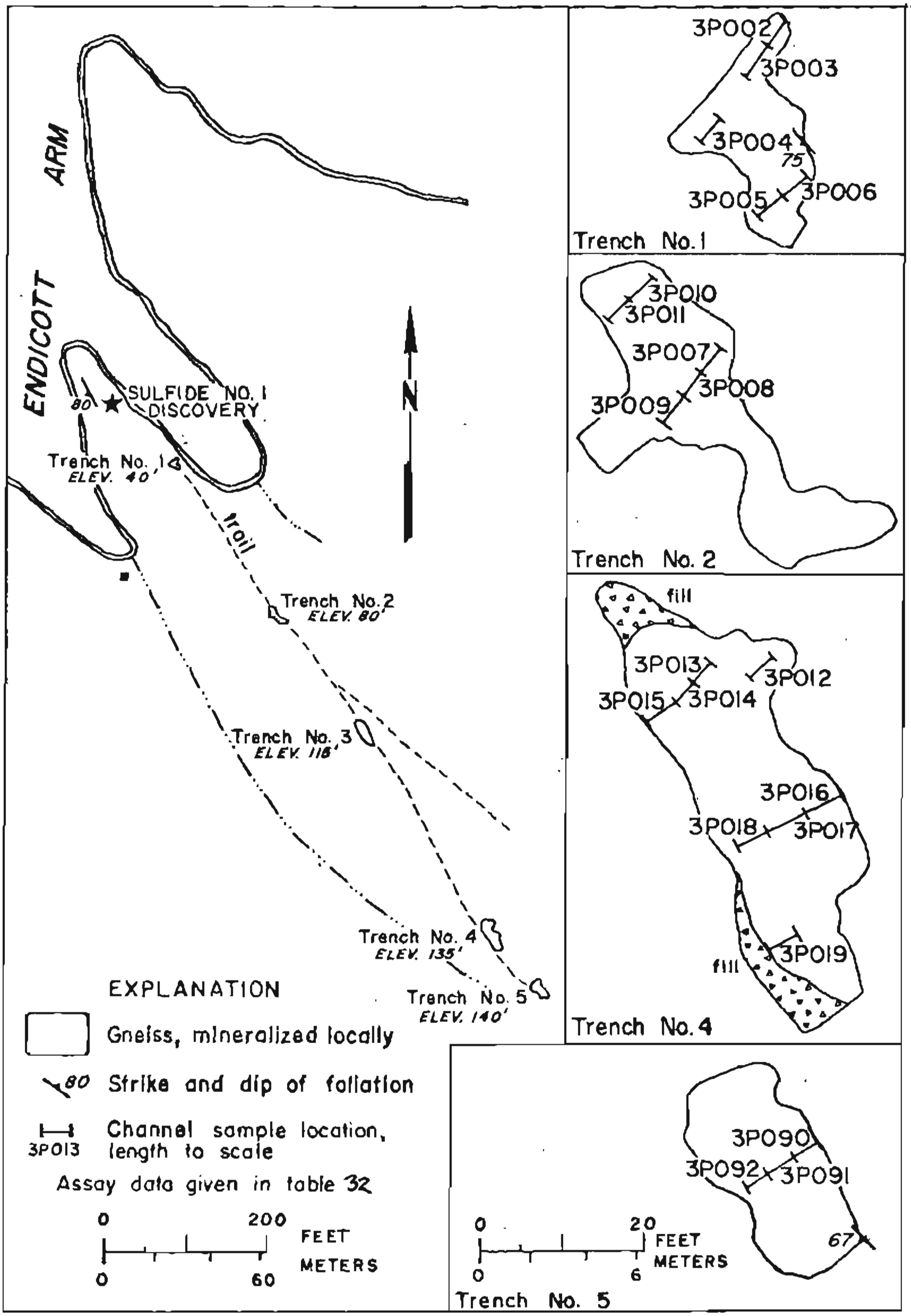
fifth open cut (#3) was unmineralized. Most of the area is covered with overburden and thick vegetation. However, some sparse sulfides are visible in rock outcrops on the beach along strike of the mineralized zone



Base from U.S. Geological Survey 1:63,360 Sumdum C-5 1951

Figure 72.--Sumdum and Bushy Islands, sample locations.

Figure 72.--Sumdum and Bushy Islands, sample locations.



Mapped by T. Pittman and A. Kimball, June 1973

Figure 73.-- Sulphide prospect, sample locations

Figure 73.--Sulphide prospect, sample locations.

The Sulphide prospect was staked in 1928 as three "Idaho" claims. It was restaked in 1939 as the 40 percent group and most of the trenching was done at that time. It was relocated as the Maybe group about 1955 and as the Sulphide group of 16 claims in 1969 and 1970. Most recently it was relocated as four "Iceburg" claims and was active in 1975.

The property was examined for gold and silver by a representative of the Alaska-Juneau Gold Mining Company in 1928. The property was again examined by J. C. Roehm, Territorial Department of Mines, in 1942 and Neil M. Muir, U.S. Bureau of Mines, in 1943.

Bands of massive sulfides up to 0.4 foot thick parallel the foliation of the rusty feldspathic gneiss and quartzite. Sphalerite, galena and chalcopyrite accompanied by pyrrhotite and marcasite follow selective horizons in minor folds and have clearly been metamorphosed. The sulfides are concentrated in the crest of small folds and as grains and stringers parallel to the foliation. The mineralized zone ranges from 5 to 15 feet wide.

During the present study, 21 channel samples were cut across the zone in four open cuts #1, 2, 4, and 5 (table 32) over a distance of

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TABLE 32 near here.

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800 feet. The five samples having the highest combined copper-lead-zinc-silver values ranged in length from 4.4 to 7.0 feet and contained 0.02 to 0.25 percent copper, 0.65 to 1.30 percent lead, and 1.25 to 1.90 percent zinc. Silver values ranged from 0.02 to 0.88 ounces per ton, and gold from nil to 0.004 ounces per ton. Sample 3P005 which cut across 5.5 feet of open cut #1 probably had the highest combined values: 0.1 percent copper, 1.3 percent lead, 1.75 percent zinc, 0.88 ounce silver per ton and a trace of gold, roughly $25 per ton at 1975 metal values.

Table 32.--Assay data, Sulphide prospect.

Sample	Type	Length Ft.	Length (m.)	Trench Number	Semiquantitative Spectrographic Analysis ppm Ag	As	Atomic Absorption ppm Au	Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
3P002	Channel	5	(1.5)	1	10	300	N	1000	2000	3500	-	-	Fine-grained, light-colored
3P003	do.	6.5	(2.0)	1	10	5000	0.10	870	3200	6000	-	-	
3P004	do.	4.5	(1.4)	1	1	2000	N	360	900	1500	-	-	contorted rusty gneiss and
3P005	do.	5.5	(1.7)	1	30	1500	L	1000	13000	17500	N	43.9	quartzite with sulfide bands
3P006	do.	5.5	(1.7)	1	5	3000	N	480	3300	5200	-	-	
3P007	do.	5.5	(1.7)	2	7	2000	N	830	4700	7400	-	-	and lenses parallel to foliation.
3P008	do.	5	(1.5)	2	10	2000	.15	2500	6500	14000	-	-	
3P009	do.	5.5	(1.7)	2	5	2000	.10	400	2000	4000	N	.3	Bands range up to 0.4-feet thick
3P010	do.	6.1	(1.9)	2	3	2000	N	300	1800	2800	-	-	
3P011	do.	4.4	(1.3)	2	20	1000	.10	1600	7600	19000	N	2.1	and contain iron sulfides with
3P012	do.	5.3	(1.6)	4	.5	1500	N	170	85	185	-	-	
3P013	do.	4.8	(1.5)	4	10	2000	.15	2200	9400	14000	N	17.1	lesser sphalerite, chalcopyrite,
3P014	do.	5	(1.5)	4	3	3000	.05	430	2900	5200	-	-	
3P015	do.	6.4	(2.0)	4	1	1500	N	300	750	600	-	-	galena and arsenopyrite. Sul-
3P016	do.	7	(2.1)	4	3	10000	.05	450	3600	6400	-	-	
3P017	do.	7	(2.1)	4	7	G10000	.05	750	9500	12500	-	-	phides tend to concentrate in
3P018	do.	6	(1.8)	4	.7	7000	L	100	700	650	-	-	
3P019	do.	5.5	(1.7)	4	N	N	N	5	25	50	-	-	small fold axes.
3P090	do.	5	(1.5)	5	5	2000	.15	1200	2200	8600	-	-	
3P091	do.	5	(1.5)	5	3	2000	.15	580	1000	6200	.3	2.4	
3P092	do.	4.5	(1.4)	5	.5	1000	N	75	200	350	-	-	

11. Reported anomaly southeast of Fords Terror

A sediment sample taken in 1973 from an unnamed stream five miles southeast of Fords Terror contained 1,000 ppm of tungsten, 2,000 ppm of arsenic and 30 ppm of beryllium (Locality No. S 131, Plate 2). In 1974 this area was examined by a field party. The drainage cuts across a biotite gneiss-granite contact. The granitic rocks are at the head of the drainage near a small glacier. Six stream sediment samples were collected from the stream, its tributaries and an alluvial fan. A search was made for mineralized float. The six samples were analyzed but no tungsten or arsenic were detected, and only traces of beryllium were present. Petrographic studies of the sediments revealed no metallic minerals. One sediment sample from the main stream contained 70 ppm molybdenum. Float near the throat of the canyon contained traces of galena, pyrrhotite and chalcopyrite. A sample from a rock outcrop contained a thin seam of pyrrhotite, and when examined petrographically it was found to contain a grain of scheelite. The original stream sediment analyses could not be duplicated. No former activity is evident and no claims are recorded.

12. Powers Creek placers

Powers Creek was prospected and mined for placer gold intermittently for more than 40 years beginning with initial gold discovery in 1869. Gold was discovered in Windham Bay the same year and in the following two years these localities were credited with $40,000 [nearly 2,000 ounces] in gold production (Spencer, 1906). The amount attributed to Powers Creek cannot be determined. Miners were there when John Muir was in Sumdum Bay (now Holkham Bay) in 1879 and 1880 (Muir, 1915). The most recent placer claim found in mining records was recorded in 1911. It is doubtful whether a large amount of gold was placered from Powers Creek.

Powers Creek which drains Sumdum Glacier falls 1,300 feet through two miles of narrow canyons to Endicott Arm. Mining probably was done in the winter during low water to allow access to the stream gravels. Because of the narrowness of the canyons, high water would probably have obliterated any vestige of former work.

Panned concentrates were taken at 13 sites randomly spaced along 600 feet of the stream near the mouth (fig. 74). The samples were taken

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Figure 74 near here.

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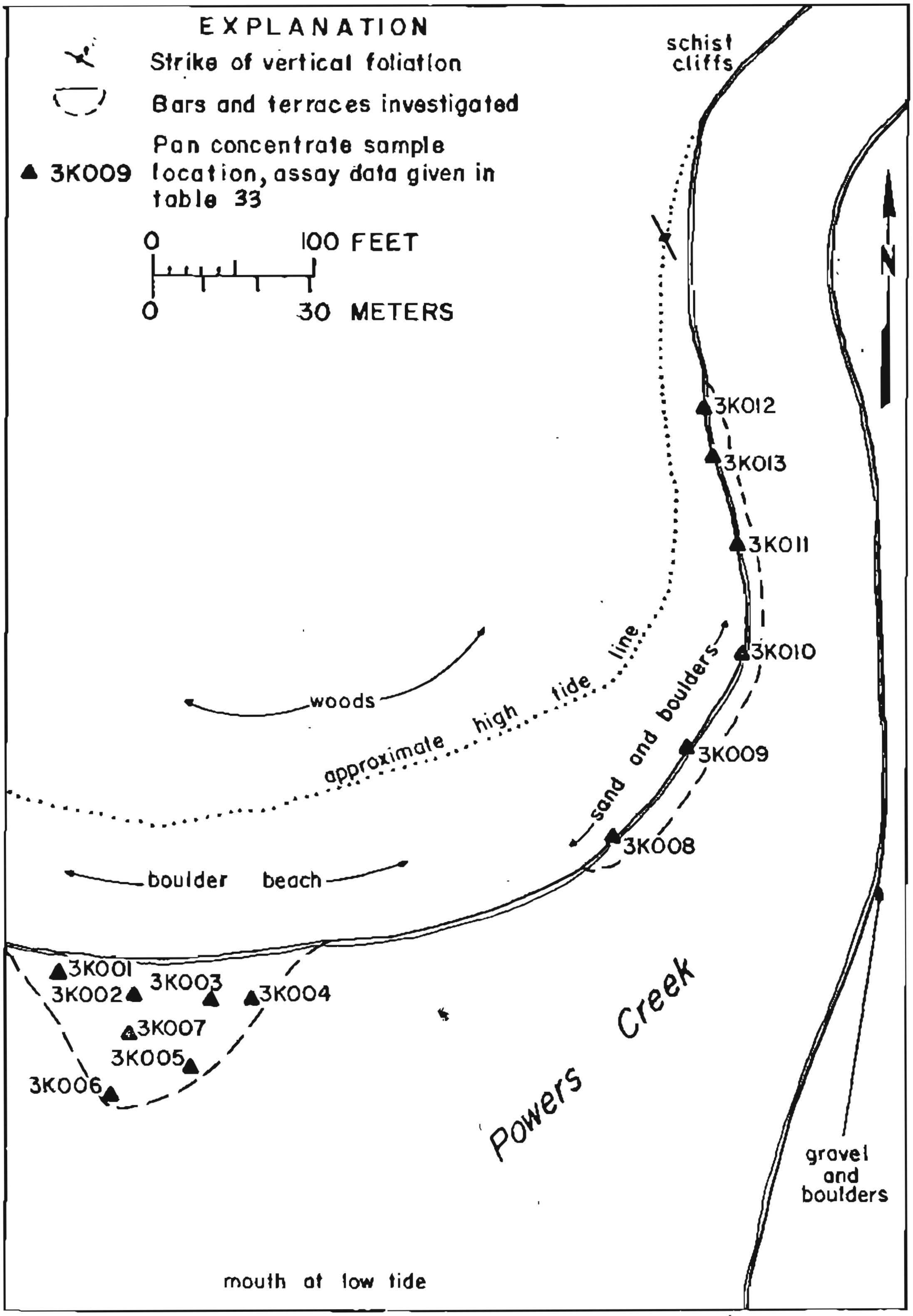
of silt sand and gravel from the stream bed and bank from between cobbles and large boulders and may represent fine materials, but not the boulder-strewn bank or bed as a whole. A few colors of gold were panned at most of these sites.

The panned concentrates were fire assayed for their total gold content. Assays are reported in ounces per cubic yard for undisturbed material (table 33). Plus and minus 80 mesh fractions of the panned

TABLE 33 NEAR HERE.

concentrates were assayed separately. Percent of gold in the samples does not necessarily correlate with one size fraction or the other, and up to nearly 100 percent can occur in either fraction. Gold particle studies on two samples which were not assayed, however, showed that the particle size ranged from 48 to 400 mesh and the mass roughly calculated from particle size was divided fairly evenly between minus and plus 80 mesh sizes. Assay values range from 0.0031 ounce per cubic yard to nil and suggest that in localities where samples were obtained, that deposits are not viable under present economic conditions. However, the areas in the canyons which were probably mined were not accessible during this study. Interest has not revived in spite of rise in gold price.

The gold source may be related to the Sumdum copper-zinc deposit which lies in the upper end of the Powers Creek drainage. Some pan concentrates from the creek contained traces of pyrrhotite and chalcopyrite. Pyrrhotite is abundant in the Sumdum deposit and chalcopyrite the dominant copper-bearing mineral. Assays show that small amounts of gold are also present in this deposit.



Mapped by T.L.Pittman and A.Kimball, June 1973

Figure 74.--Powers Creek placers, sample locations

Figure 74.--Powers Creek placers, sample locations.

Table 33.--Assay data, Powers Creek placers.

Sample	oz/cu yd
3K001	0.0003
3K002	N
3K003	.0004
3K004	.0004
3K005	N
3K006	N
3K007	N
3K008	.0002
3K009	.0031
3K010	.0005
3K011	.0002
3K012	.0004
3K013	.0001

1/ Calculated from mg total gold by fire assay analysis (14 in. pan at 270 pans/cu yd)

Fords Terror area

Two iron-stained areas, one in a valley located north of the head of Fords Terror and the other within Fords Terror, were sampled; figure 75

Figure 75 near here.

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shows the areas visited and the sample locations.

A significant portion of the valley at the head of Fords Terror is colored red by iron staining over gneiss. Apparently the cause of the iron staining is the weathering of biotite and very finely disseminated sulfides in the gneiss of the area. Five spaced chip samples taken gave barely anomalous results; one contained 300 ppm zinc, one contained 30 ppm molybdenum, and all five contained L to 1 ppm silver. Table 34 gives

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TABLE 34 NEAR HERE.

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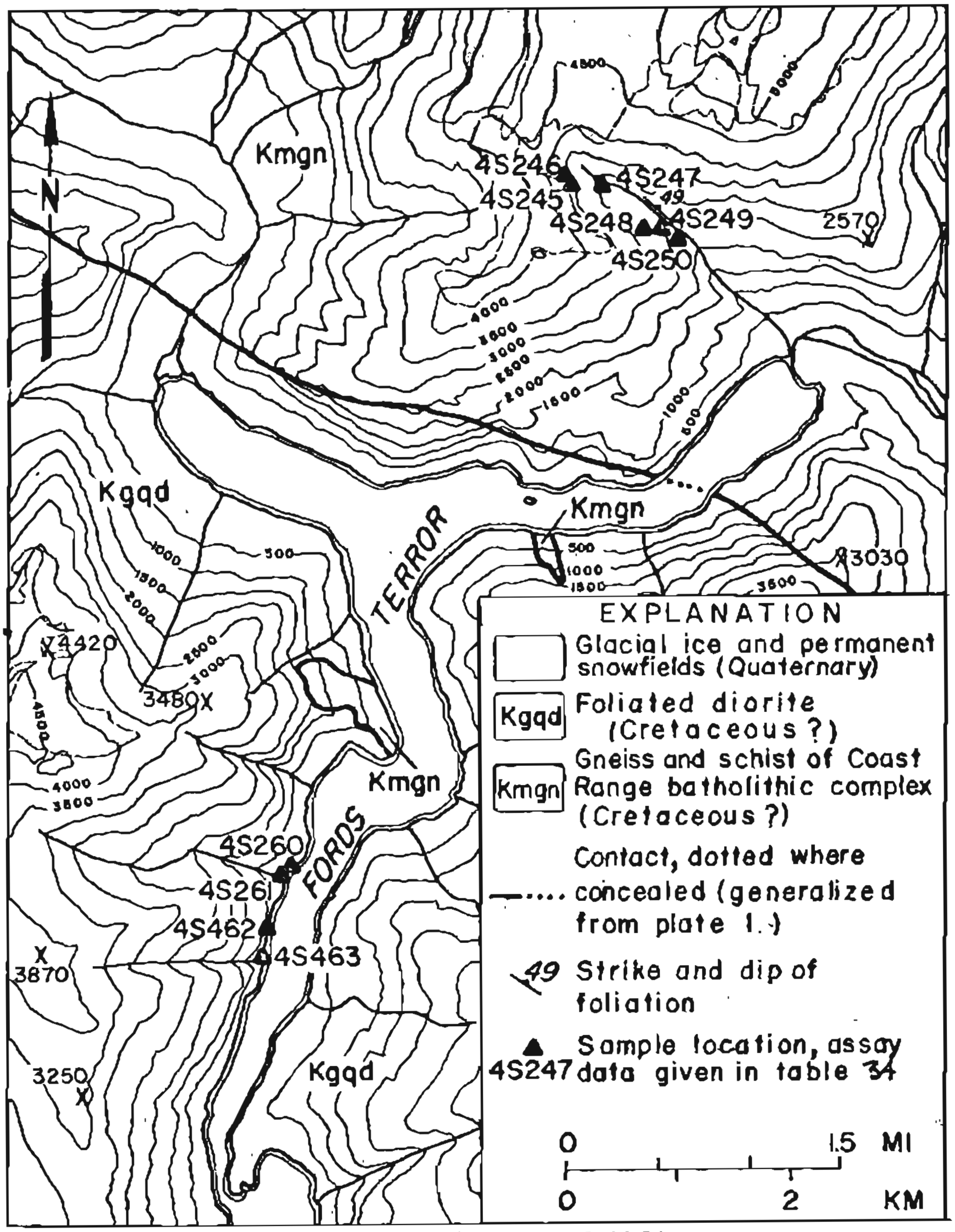
the analytical results.

The other area visited was in Fords Terror itself. A number of prominent altered fault zones occur in the north-south arm of Fords Terror. Five samples taken across these fault zones near sea level indicated no significant metal values (table 34).



Base from U.S. Geological Survey 1: 63,360 Sumdum C-4 1961

Figure 75.--Fords Terror area, sample locations

Figure 75.--Fords Terror area, sample locations.

Table 34.--Assay data, Fords Terror area.

Sample	Type	Length		Semiquantitative Spectrographic Analysis ppm		Atomic Absorption ppm		Description
		Ft.	(m.)	Ag	Mo	Cu	Zn	
				Valley at head of Fords Terror				
4S245	Spaced chip, 1-ft. interval	32	(9.8)	1	15	100	100	Iron-stained gneiss.
4S246	Chip	1	(0.3)	N	N	15	110	Gneiss with calcite vein.
4S247	Spaced chip, 1-ft. interval	20	(6.1)	.7	30	50	300	Iron-stained gneiss.
4S248	Spaced chip, 2-ft. interval	124	(37.8)	1	7	160	160	do.
4S249	do.	150	(45.7)	.7	10	110	100	do.
4S250	Spaced chip, 0.25-ft. interval	7	(2.1)	L	N	75	45	do.
				Fords Terror				
4S260	Channel	2.5	(0.8)	N	20	L	100	Altered granite in fault zone.
4S261	Spaced chip, 0.5-ft. interval	13	(4.0)	N	N	5	40	do.
4S262	Channel	5.5	(1.7)	N	N	L	120	do.
4S263	Spaced chip, 0.5-ft. interval	20	(6.1)	N	N	5	60	do.

Ultramafic belt

The discontinuous belt of ultramafic rocks which extends in a generally northerly direction through the Coast Range batholithic complex (see geology section of this report) was examined and sampled in reconnaissance. In addition to the usual chemical analyses, selected samples were analyzed for platinum group metals.

As discussed in the geochemistry section, these rocks are (as expected) characterized by high nickel and chromium background values, but no accumulations of sulfides or chromite were noted. The nickel and chromium values are not anomalous for these kinds of rocks. Analysis of selected samples for platinum group metals did not show unusual values. It appears that the belt has no significant mineral potential.

Whiting River silver-gold prospect

The Whiting River silver-gold prospect is located about 8 miles up the Whiting River and about 2 miles southeast of the river near the base of a glacier at an elevation of 2,900 feet. It can be reached by a 3.5-mile trail from the river. The prospect has been known since 1896 and has been located as the Lost Charlie Ross in 1901 and 1907, the Miss Pickle in 1913, the Silver Moon in 1915 and again as the Miss Pickle in 1929 according to Buddington (1923, p. 135) and the Juneau recording office records. The claims are not presently active.

A 4.5-foot wide sulfide-bearing quartz vein in dolomitic limestone is exposed in an open cut on a steep hillside. About 80 feet of vein are exposed. The sulfides are arsenopyrite, pyrite, pyrrhotite, sphalerite, galena and chalcopyrite with the gold values probably in the arsenopyrite and the silver values in the galena.

About 100 feet below this open cut, a 75-foot-long cross-cut was driven in an apparent attempt to intersect the vein exposed at the open cut. Figure 76 is a map showing the location of the open cut, adit,

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Figure 76 near here.

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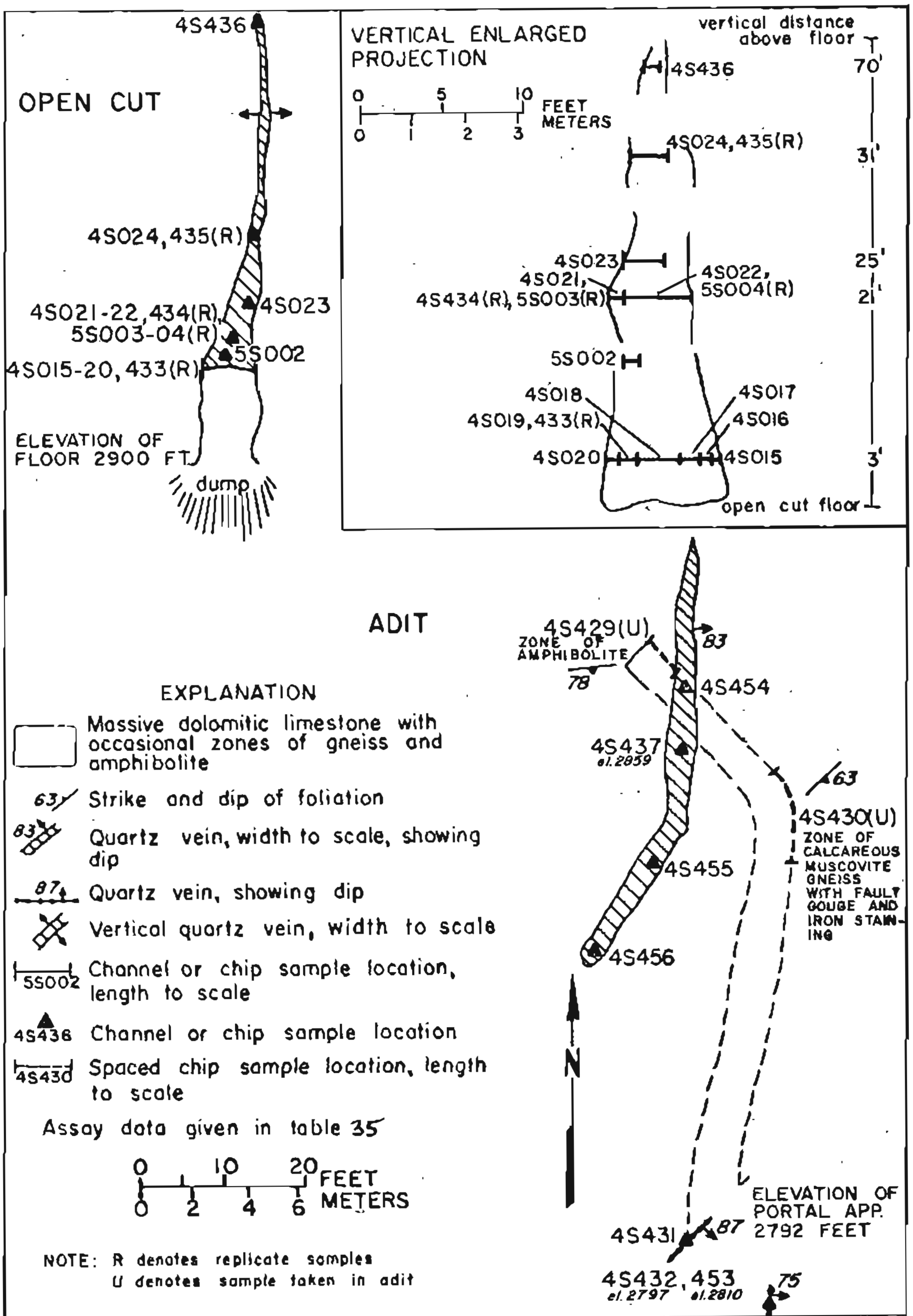
veins and samples. Most of this work probably was done prior to 1908, as Brooks stated in 1909 (p. 139) that this cross-cut had been driven 70 feet at that time.

A study of the general geology of the area reveals several sulfide-bearing quartz veins penetrating the dolomite country rock. The veins appear to be completely faulted. The 4.5-foot-wide vein explored by the open cut disappears into barren dolomite just below the floor of the cut. Faulting is a likely explanation for this abrupt truncation. About 70 feet southeast of the open cut, another sulfide-bearing quartz vein with a maximum thickness of 3 feet is exposed along a steep slope. It thins and pinches out at its upper end while its lower end decreases to a thickness of 2.5 feet, then disappears beneath a mudslope and fails to reappear in the rock below. Three additional mineralized veins were seen. The first, about 0.1 feet thick, is situated at the entrance to the cross-cut. The second, about 0.2 feet thick, is isolated about 10 feet south of the cross-cut. A third vein, about 0.8 foot thick, outcrops for about 30 feet at the same elevation and about 250 feet southeast of the open cut. (This vein sample 4S458 is not shown in figure 76.) All sulfide-bearing veins seen have an approximate strike of N. 05° E. and have very steep or vertical dip. These veins contain significant anomalous quantities of silver, gold, and, locally, lead and zinc. With the exception of the open cut vein, they are not extensive enough nor high enough in grade to be of economic significance. Figure 76 shows the vein and sample locations and table 35 gives the assay results.

TABLE 35 NEAR HERE.



Mapped by J. Still, M. A. Parke and K. Weir, August 1974

Figure 76.-- Whiting River silver-gold prospect, sample locations. Plan and vertical projection

Figure 76.--Whiting River silver-gold prospect, sample locations. Plan and vertical projection.

Table 35.--Assay data, Whiting River silver-gold prospect.

Sample	Length Ft.	(cm.)	Type	Semiquantitative Spectrographic Analysis ppm Ag	As	Atomic Absorption ppm Au	Cu	Pb	Zn	Fire Assay ppm Au	Ag	Description
						Open cut						
4S015	0.5	(15)	Channel	L	N	N	20	90	200	-	-	Limestone.
4S016	.75	(23)	do.	N	N	N	100	30	190	-	-	Tactite.
4S017	1.25	(38)	do.	N	N	N	20	75	260	-	-	Limestone.
4S018	2.5	(76)	do.	15	1500	0.05	110	1200	340	N	13.0	Quartz vein.
4S019	1.1	(34)	do.	200	G10000	7.5	530	18000	7900	7.5	393.5	Quartz vein with sulfide band.
4S020	.9	(27)	do.	15	1500	.25	1500	3600	2400	N	11.7	Dolomite limestone.
4S021	1.0	(30)	Chip	300	G10000	26.0	410	24000	11000	56.9	1076.7	Quartz vein with sulfide band.
4S022	4.0	(122)	do.	15	7000	.25	150	2600	4800	1.0	54.5	Limestone with quartz with sulfides.
4S023	2.7	(82)	do.	200	G10000	3.5	640	26000	1600	3.6	189.2	do.
4S024	2.5	(76)	Channel	150	1500	.05	980	22000	3300	3.8	88.4	Quartz vein.
4S433	1.1	(34)	do.	300	G10000	31.0	320	15000	17000	10.3	319.8	Replicate of 4S019.
4S434	1.0	(30)	Chip	1000	G10000	7.0	520	12000	6500	8.6	1807.9	Replicate of 4S021.
4S435	2.5	(76)	Channel	500	5000	2.5	1700	50000	15000	3.1	793.2	Replicate of 4S024.
4S436	1.2	(37)	Chip	7	G10000	1.0	100	700	740	-	-	Limestone with quartz with sulfides.
5S002	1.4	(43)	Channel	1000	G10000	14	3700	46000	14000	15.5	992.4	Quartz vein with sulfide band containing pyrite, galena and some chalcopyrite.
5S003	.9	(27)	do.	1000	G10000	34	90	35000	920	22.7	878.9	Replicate of 4S021.
5S004	2.9	(88)	Chip	150	5000	48	180	13000	510	0.8	73.7	Replicate of 4S022.
						Sulfide-bearing quartz vein 70 feet southeast of the open cut						
4S437	3.0	(91)	Chip	20	500	.60	130	1000	440	-	-	Quartz vein.
4S454	1.9	(58)	Channel	7	N	N	55	250	260	-	-	Quartz vein.
4S455	1.8	(55)	do.	1	N	N	45	150	150	-	-	do.
4S456	2.4	(73)	do.	15	N	L	50	630	40	-	-	do.
						~~Adit~~ Crosscut						
4S429	6.0	(183)	Chip	N	N	N	45	10	55	-	-	Amphibolite with albite and mica.
4S430	12	(366)	Spaced chip, 0.25-ft. interval	N	N	N	85	20	75	-	-	Iron-stained gouge zone.
4S431	.1	(3)	Channel	3	500	N	15	470	150	-	-	Quartz vein.
						Other sulfide-bearing quartz veins						
4S432	.2	(6)	Channel	70	700	2.5	4000	18000	11000	-	-	Quartz vein with sulfides.
4S453	.1	(3)	do.	30	N	N	1100	210	15000	-	-	Quartz vein with sulfides.
4S458	.8	(24)	do.	7	N	N	270	5000	10	-	-	Quartz vein with sulfides.

The 2,792-foot elevation cross-cut is driven in dolomite through most of its 75-foot length except for 12 feet of calcareous muscovite gneiss 42 feet from the portal, and a 6-foot zone of amphibolite located near the face. A N. 45° W. 50-foot extension of the cross-cut should intersect the projected trend of the sulfide-bearing quartz vein exposed in the open cut, about 105 feet down the dip of the vein. However, since the cross-cut does not intersect the large quartz vein exposed on the surface 40 feet above it and since the open cut vein is not exposed on the surface below an elevation of 2,900 feet, a fault between the cross-cut and two veins is suggested. The subsurface trend of the open cut vein important in the prospect evaluation can only be projected from exposures and makes the evaluation highly speculative.

The open cut vein gave the only significantly economic assay returns of the five veins sampled. This vein truncates abruptly below the floor of the open cut at a 2,900-foot elevation. Above the open cut, the vein gradually thins out vertically and the sulfides pinch out at an elevation of 2,970 feet and the quartz just above. The lower 51 feet of this sulfide-bearing quartz vein have the best assay values. Silver values range from 3.4 to 14.5 ounces per ton calculated at a mining width of 4 feet and average 10.2 ounces per ton. Average gold values of 0.09 ounces per ton and average lead values of 2.20 percent were also obtained. The values exposed would constitute ore only if several hundred thousand tons were found by subsurface exploration.

Investigations in the vicinity of the Whiting River silver-gold prospect

The area between the Whiting River silver-gold prospect and to one mile northeast of it was investigated. The Capped-Over claim staked in 1913 could be in this area. The geology of this area is complex. The dominant rock units are limestone, felsic and mafic dikes, and granitic rocks. A 24-foot spaced-chip sample taken across an outcrop of iron-stained granodiorite assayed at 3 ppm silver. The area contained no mineralized zones or claims.

A traverse was made along the ridge from 1/2 mile northeast of peak 4816 to peak 3894. This ridge is about 1/2 mile northwest of the Whiting River silver-gold prospect. The Capped-Over claims could also be located in this area. This is also an area of complex geology, granite, gneiss, schist and limestone occasionally cut by quartz veins. No significant mineralized zones were found.

Other claims and claim groups

More than a third of the claims described in mining records as in the area are not directly associated with the prospects and properties previously discussed.

Locating mining claims in the field is difficult because of deterioration of the claim corners, the ambiguity of point or reference relative to claim locations, and vegetation. Since the recording of assessment work is not mandatory, records often do not specifically note a lapse of the claims unless a notice of abandonment is filed. This is very rare. The claim locations are also confused by restaking in the same or new configuration, sometimes repeatedly.

The following paragraphs briefly discuss the results of ground search in a number of "other" areas where claims were located, probably were located, and may have been located.

Vicinity Tracy and Endicott Arms

BBH #1 prospect

In 1955, the BBH #1 claim was staked over several small, slightly radioactive pegmatitic albite lenses on the southeast side of the branch of Endicott Arm that drains the North Dawes Glacier (plate 3, location C-7). The claim is inactive. In 1970, Gilbert R. Eakins (Eakins, 1975) examined the prospect and reported two pegmatite samples which assayed 35 and 45 ppm uranium.

Our investigation revealed four elliptical altered zones containing pegmatitic albite lenses in granodiorite at elevations of 45 feet, 60 feet, 85 feet and 135 feet along a steep stream. The largest was about 120 feet by 20 feet, and the smallest was 45 feet by 35 feet. A geigercounter traverse was made of each zone resulting in readings from slightly over background up to twice the background of 0.02 milliroentgens per hour.

Spaced-chip samples ranging in length from 5 feet to 13 feet were taken across each zone. Uranium values ranged from 0.2 ppm to 16.1 ppm (analysis by fluorimetry). Uranium minerals weather rapidly so subsurface sampling may reveal higher uranium values. The samples contained traces of copper, silver, and lead.

Indications are that this deposit is too small and low grade to be of economic interest.

Straight Creek

Several claims were reported on Straight Creek before World War I. Although the name of the creek has not been preserved, Straight Creek probably is the stream that follows regional structure and enters Endicott Arm north of Sumdum Island. No indication of claims or of work was found. Samples of two thin quartz veins following the foliation of the schists contained no significant metallic values (plate 3, location C-4).

Barnacle

Barnacle No. 1 and 2 claims, which were reportedly located a mile above Fords Terror on Endicott Arm in 1900, were investigated but no sign of claims or work was found. A channel sample of a 0.7-foot quartz vein in rusty weathering schist indicates 370 ppm copper. Samples of a second vein and of the rusty schist in the area gave no significant values (plate 3, location C-6).

East of Bushy Island

A 3-foot thick quartz vein obliquely cutting phyllites just above high tide on the shore of Endicott Arm east of Bushy Island gave only background metal values (plate 3, location C-5). Claims were recorded somewhere in this area in 1914. This vein and a thinner one nearby are the only features seen in the vicinity which might have interested early prospectors.

Head of Williams Cove

Conspicuous, brown-weathering schists at the head of Williams Cove contain finely disseminated pyrite and quartz stringers that parallel foliation. Two chip samples across 9 feet of schist contained no anomalous values (plate 3, location C-2). Neither claims nor workings have been reported in the vicinity.

West shore of Tracy Arm

The area on the west shore of Tracy Arm due west of the bend in the elbow was investigated. Weathered brown schists with disseminated pyrite and irregular quartz stringers were spaced-chip sampled for 40 feet across the structure in two sample sections (fig. 64). Both contained 0.5 ppm silver and one 20 ppm molybdenum. These rocks lie in the Sumdum Glacier mineralized belt. Several claims are reported to have been located on this side of the arm prior to 1900 and several others between 1915 and 1920. Only a cursory inspection was warranted because of the ambiguous nature of the location description.

The Whale Back lime-marble deposit

The Whale Back lime claim as it was referred to by the locator was recorded in 1923 as situated 20 miles up Tracy Arm. Although the exact location of this claim is uncertain, Buddington (1906) mapped marble in several locations in upper Tracy Arm and showed marble in one locality about 20 miles up the Arm. The most prominent marble exposure in the vicinity occurs at the mouth of a stream and was chip sampled across foliation for about 250 feet in five spaced chip samples (plate 3, location C-3. The marble contained a little more than 50 percent calcium and magnesium carbonates; the remainder is largely silica. This marble deposit as it is now known is not of any economic interest.

Point Coke

The Hecla, Calamet, Black Hawk, Grey Eagle and Chicago claims were located near Point Coke near the turn of the century and in the 1920's.

Samples were taken of a 240-foot wide area of quartz veining and minor sulfide mineralization in schist located just below the high tide line about 700 feet northeast of Point Coke. Figure 77 shows the location of the samples. Of 24 samples taken only one sample, a 2.5-foot channel across a quartz-feldspar vein had any metal values of significance, 300 ppm copper.

Speel Arm vicinity

Speel River quartz claim

The Speel River quartz claim, staked in 1913, is described as being below the junction of Indian Creek and the Speel River, and 6 miles north from the iron rod on Star Point (plate 3, location C-1). An investigation was made of the point from where the cable tram crosses the Speel River west to timberline at 2,300 feet elevation. This area consists of schist, gneiss, and granite with occasional quartz veins and stringer zones. No mineralized areas were found.

Iron-stained zones near the International Boundary

Prominent orange to red-stained zones are abundant in the gneissic rocks of the rugged mountains of the Coast Range batholithic complex from the Canadian border to about 10 miles west. The trend of these stained zones generally coincides with the trend of the batholithic complex but cross-cutting relationships are common. The most prominent, accessible zones were investigated (plate 3, localities S-1 through S-12) and sampled. Sample results are given in table 36. Most samples were

TABLE 36 NEAR HERE.

spaced chip. Total sample length and interval was estimated in some instances and measured in others. Our investigation did not reveal significant mineralization. Occasional isolated samples were slightly anomalous in silver, gold, copper, molybdenum, lead or zinc. Petrographic investigation revealed that the red stain was caused by the weathering of very finely disseminated pyrrhotite or biotite. In all cases the stain was only a thin surface covering only fractions of an inch thick. There are no known mineral deposits near any of the areas investigated. The results of our investigations do not indicate that mineral deposits are associated with the red stained zones.

Table 36.--Assay data, Iron-stained zones near the International Boundary.

Sample	Type	Length Ft.	(m.)	Semiquantitative Spectrographic Analysis ppm Ag	Mo	Atomic Absorption ppm Cu	Pb	Zn	Description
				Speel Lake stained zone (location S-1)					
5K025	Spaced chip, 1-ft. interval	27	(8.2)	N	N	40	15	65	Iron-stained gneiss with traces of finely-disseminated iron sulfides.
5K026	do.	19	(5.8)	N	N	55	15	55	do.
5K027	do.	40	(12.2)	N	N	65	15	75	do.
5K028	do.	24	(7.3)	N	N	45	15	65	do.
				Speel River stained zones (location S-2)					
5K035	Spaced chip, 1-ft. interval	24	(7.3)	L	5	65	10	75	Iron-stained gneiss.
5K036	Random grab	-	-	N	5	130	10	35	Composite of float from boulder fan below iron-stained cliff.
				Speel River stained zones (location S-3)					
5K034	Spaced chip, 1-ft. interval	90.5	(27.6)	1	5	55	10	100	Moderately iron-stained siliceous gneiss.
				Red Mountain prospect (location S-4)					
4K003	Spaced chip, 1-ft. interval	50	(15.2)	L	15	10	10	45	Iron-stained gneiss with no visible sulfides.
4K004	Spaced chip, 2-ft. interval	30	(9.1)	L	10	5	15	55	do
4S025	do.	100	(30.5)	0.7	7	50	60	50	do.
4S026	do.	50	(15.2)	0.5	L	50	85	75	do.
4S027	do.	88	(26.8)	L	10	45	20	85	do.
4S029	do.	47	(14.3)	L	10	80	10	60	do.
5S029	Spaced chip, 1-ft. interval	16	(4.9)	N	15	70	10	95	
5S030	do.	50	(15.2)	N	10	55	5	50	
5S031	Stream sediment	-	-	N	N	20	5	45	
5S032	do.	-	-	N	N	30	5	65	
5S033	do.	-	-	L	N	15	5	50	
5S034	do.	-	-	N	N	25	5	65	
5S035	do.	-	-	N	N	35	10	50	

Table 36.--Assay data, Iron-stained zones near the International Boundary, continued.

Sample	Type	Length Ft.	Length (m.)	Semiquantitative Spectrographic Analysis ppm Ag	Mo	Atomic Absorption ppm Cu	Pb	Zn	Description
				Red Mountain prospect (location S-4)-continued					
5S036	Stream sediment	-	-	N	N	95	10	95	
5S037	do.	-	-	N	N	20	10	45	
5S038	Spaced chip, 2-ft. interval	65	(19.8)	3	7	80	10	110	Iron-stained gneiss with no visible sulfides.
5S039	do.	75	(22.9)	1.5	10	65	5	110	do.
5S040	do.	77	(23.5)	1	5	60	10	90	do.
5S041	Stream sediment	-	-	N	N	35	10	45	
5S042	do.	-	-	N	20	35	10	70	
5S043	do.	-	-	N	N	35	10	90	
5S044	do.	-	-	N	N	20	5	50	
5S045	do.	-	-	N	N	30	5	90	
				Triangulation station "Cook" (location S-6)					
5S052	Spaced chip, 1-ft. interval	30	(9.1)	N	N	40	10	85	Iron-stained gneiss
5S053	do.	30	(9.1)	L	L	45	5	70	do.
5S054	do.	26	(7.9)	1	N	25	5	70	do.
5S064	do.	45	(13.7)	L	10	60	10	130	do.
5S065	do.	90	(27.4)	1	5	65	10	100	do.
				Whiting River stained zone (location S-7)					
5K001	Composite grab	100	(30.5)	1	5	120	15	100	High-grade selection of talus at base of iron-stained cliffs.
5K002	do.	100	(30.5)	1	15	120	15	95	do.
				Stained zones near the Sawyer Glaciers (location S-8)					
4K280	Spaced chip, 2-ft. interval	66	(20.1)	N	10	45	L	35	500 ft. + stratigraphic sample section across heavily iron-stained biotite gneiss with traces of disseminated pyrrhotite.
4K281	do.	150	(45.7)	N	L	35	L	35	
4K282	do.	150	(45.7)	N	15	30	L	30	
4K283	do.	150	(45.7)	N	L	30	L	30	
4K284	Composite grab	200	(61)	N	N	75	5	50	

Table 36.--Assay data, Iron-stained zones near the International Boundary, continued.

Sample	Type	Length Ft.	Length (m.)	Semiquantitative Spectrographic Analysis ppm Ag	Mo	Atomic Absorption ppm Cu	Pb	Zn	Description
Stained zones near the Sawyer Glaciers (location S-9)									
4K309	Spaced chip, 4-to 5-ft. interval	2500		N	15	50	15	60	Heavily iron-stained biotite gneiss with an occasional trace of pyrite. Some small unstained irregular masses of granite.
4K310	do.	feet		N	10	60	35	60	
4K311	do.			N	10	55	10	65	
4K312	do.		(762 m.)	N	7	45	15	55	
4K313	do.			N	15	50	5	60	
4K314	do.	total length		N	20	65	5	45	
4K315	do.			N	7	35	5	45	
4K316	do.	across		N	15	70	5	50	
4K317	do.			N	L	55	5	55	
4K318	do.	structure		N	7	75	5	55	
Stained zones near the Sawyer Glaciers (location S-10)									
4S445	Spaced chip, 15-ft. interval	600	(182.9)	N	15	75	5	100	Iron-stained gneiss.
4S446	do.	250	(76.2)	N	15	65	10	65	do.
4S447	Spaced chip, 5-ft. interval	30	(9.1)	N	N	45	5	30	do.
4S448	Spaced chip, 2-ft. interval	8	(2.4)	N	30	150	5	50	do.
4S449[1]	do.	36	(11.0)	N	N	35	5	30	do.
4S450	do.	90	(27.4)	N	N	40	5	30	do.
4S451	do.	30	(9.1)	N	N	40	10	95	do.
4S452	do.	60	(18.3)	N	10	60	5	75	do.

Table 36.--Assay data, Iron-stained zones near the International Boundary, continued.

Sample	Type	Length		Semiquantitative Spectrographic Analysis ppm		Atomic Absorption ppm			Description
		Ft.	(m.)	Ag	Mo	Cu	Pb	Zn	
				Stained zones near the Sawyer Glaciers (location S-11)					
4S384	Spaced chip, 15-ft. interval	100	(30.5)	N	N	20	5	40	Iron-stained gneiss.
4S385	do.	600	(182.9)	N	N	25	5	45	do.
4S386	do.	200	(61.0)	N	N	40	5	45	do.
4S387	do.	400	(122.0)	N	N	30	5	40	do.
4S388	do.	350	(106.7)	N	N	20	5	45	do.
4S389	do.	200	(61.0)	N	N	25	5	50	do.
4S390	do.	350	(106.7)	N	N	35	10	50	do.
4S391	do.	550	(167.6)	N	N	25	5	40	do.
4S392	do.	400	(122.0)	N	N	25	5	40	do.
4S393	do.	200	(61.0)	N	N	30	5	50	do.
				Stained zones near the Sawyer Glaciers (location S-12)					
4S394	Spaced chip, 15-ft. interval	500	(152.4)	N	N	45	5	35	Iron-stained gneiss.
4S395	do.	300	(91.4)	N	N	35	5	25	do.
4S396	do.	500	(152.4)	N	N	35	L	25	do.

1/ Atomic absorption analysis gave 0.10 ppm Au. . Fire assay analysis gave N and 0.7 ppm, respectively, Au and Ag.

Speel Lake stained zone

Banded gneiss with traces of finely disseminated iron sulfides and patchy but conspicuous iron staining is exposed near the terminus of a 2-mile long glacier flowing southeastward from Mount Fremont Morse (plate 3, locality S-1). Four spaced chip samples, from 19 to 40 feet taken across the foliation of two of the more intensely stained outcrops of gneiss, contained no anomalous metal values.

Speel River stained zones

Rusty zones were examined at two localities just east of the Speel River. The first (plate 3, locality S-2) comprises heavily iron-stained gneiss very similar to that on which the Red Mountain claim group was located about one mile on strike to the southeast. This stained zone was accessible only by climbing a long, steep gully on avalanche snow. Some float fragments found enroute contained small grains of iron sulfides. Neither a 24-foot spaced chip sample (5K035) of the most intensely stained rocks in a cliff nor a composite (5K036) of stained float fragments from the fan below the cliff contained significant metal values.

The second stained zone roughly two miles to the northeast of the above (plate 3, locality S-3) consists of an isolated nunatak in a high cirque which was spaced chip sampled (5K034) across its 90.5-foot width. The rocks are siliceous gneisses with moderate surface iron staining. The analysis indicated no significant metal values.

Red Mountain

Six Red Mountain claims were located in 1956 about four miles west-northwest of Crescent Lake in a U-shaped valley that heads in a glacier. These claims were located over an area of red-stained gneiss with rare disseminated sulfides. Plate 3, location S-4, shows the sample locations and the assay returns are shown in table 36. Nine spaced chip samples varying in length from 16 feet to 100 feet were taken of the most prominently stained areas. There were no significant metal values. One sample contained 170 ppm zinc, two 60 and 85 ppm lead, and five contained up to 1 ppm silver. Fourteen stream sediment samples were taken in the main and tributary streams that drain this valley. None of these samples were anomalous.

Mount Brundage stained zone

Conspicuous iron-stained siliceous gneiss on Mount Brundage is exposed in cliffs between 1 and 1.5 miles southeast of the summit (plate 3, locality S-5). Four spaced chip samples ranging from 32 to 51 feet in length totaled 167 feet across foliation and were found to contain no significant metal values although minor disseminated pyrrhotite and traces of chalcopyrite were identified in the laboratory.

A grab sample of massive pyrrhotite from a large gneissic boulder found in a lateral moraine at 3,940 feet elevation contained 540 ppm copper and 150 ppm cobalt. No other such float was found in the moraine, nor could the source be identified.

Stream sediment samples were collected from two gullies draining the mountainside in the vicinity of the stained gneiss. Analytical results did not indicate significant metal values.

Triangulation Station Cook

Triangulation Station Cook (plate 3, locality S-6) is located south of the Whiting River about four miles west of the Canadian border. Two prominent stained zones were investigated, one 100 feet wide located 0.3 mile southwest of Point Cook and the other 175 feet wide located 0.1 mile northeast from Point Cook. The western stained zone is located along a gneiss granite contact; the eastern zone is in gneiss. Spaced chip samples were taken across each zone but only traces of silver were found in each.

Whiting River stained zone

Iron-stained cliffs 3,000 feet above on the north side of the Whiting River consist of metamorphic rocks just east of a diorite contact (plate 3, locality S-7). Thin veinlets of pyrrhotite follow foliation in some of the fragments in the talus. Staining was intense only on vertical cliff faces. Two parallel 100-foot composite grab samples collected in the talus face at the base of the cliffs contained 1 ppm silver (5K001 and 5K002).

Stained zones near Sawyer Glaciers

Spaced chip samples were collected in more or less continuous sections normal to structure of two exposures situated 6 miles apart and about 2 miles west of the International Boundary. Ten spaced chip samples from the northerly of the two exposures (plate 3, location S-8) comprise a sharp northeast trending ridge separating two icefields. Vivid red-brown staining of the high cliff forming the southeast side is as intense as any seen in the study area. Chips of the ten spaced-chip samples were collected at intervals of 4 to 5 feet and cross about 2,000 feet of structure in all. Three of the samples contained 15 to 20 ppm molybdenum, and a fourth 70 ppm lead (table 36). No other anomalous values were obtained. Rocks are stained biotite gneisses with irregular granitic masses. No sulfides were seen in the field.

The second exposure (plate 3, locality S-9), 6 miles southeasterly, is composed of less colorful gneiss. Four chip samples on 2-foot spacing cross 400 feet normal to structure. A fifth random composite chip covered another 200 feet to the southwest. One of the first four samples contained 15 ppm molybdenum (table 36). The five samples yielded no other interesting metal values.

Three other prominently stained zones near Sawyer and south Sawyer Glaciers were sampled (plate 3, localities S-10, S-11, and S-12). Most of these were sampled by spaced chip. Analytical results are shown in table 36.

Samples taken in localities S-11 and S-12 did not contain significant metal values. Eight samples were taken in locality S-10; four contained 10 ppm to 30 ppm molybdenum, and one 30-foot sample across stained gneiss contained 0.10 ppm gold.

Miscellaneous occurrences

Anomaly east of Whiting River

Two of several stream sediment samples taken east of the Whiting River between two lakes during the reconnaissance geochemical sampling contained barely anomalous molybdenum. In an attempt to locate the source, a stream sediment and pan concentrates were taken in the area (plate 3, location M-3). Local rocks are dioritic. Five samples contained from 5 to 20 ppm molybdenum. Also, 0.35 ppm gold occurred in the stream sediment sample but not in the concentrate at the same locality. More detailed sampling would be necessary to isolate possible sources of the mineralization but it does not appear to be significant.

Anomaly near the head of Tracy Arm

Slightly anomalous molybdenum values were found in stream sediments from the large glacial stream flowing northeastward into the head of Tracy Arm (plate 3, location M-5). A possible source is an alaskite body west of the stream. During a brief follow-up examination, two stream sediments and two pan concentrates were obtained from a stream draining the alaskite. A stream sediment and a pan concentrate were also taken in the main stream above this tributary. Molybdenum was not detected in any of these samples.

Whiting River anomaly

A stream sediment sample which contained 100 ppm silver was taken near the mouth of a stream flowing into the north side of the Whiting River at a point about 8.5 miles from the mouth of the Whiting River (plate 3, location M-1).

In an attempt to locate the source of this significant value, stream sediment samples were taken at seventeen locations along this stream from an elevation of 1,325 feet to its mouth at the Whiting River. Six samples were taken near the mouth of the stream in the vicinity of the original sample. None of the samples contained detectible silver or anomalous metal values; and reanalysis of the original sample did not show detectible silver.

Tracy Arm hanging valley

Slightly anomalous gold and silver values were reported in a geochemical rock sample taken near the mouth of a hanging valley about 3 miles northwest of the Tracy Arm elbow (plate 3, locality M-4). Examination of the area revealed several heavily iron-stained quartz pods which parallel the foliation of the gneiss. A 15-foot continuous chip sample (5K041) across the largest and most heavily stained pod gave 100 ppm molybdenum and 200 ppm copper. Two other continuous chip samples across similar but smaller pods indicated insignificant metals. Traces of molybdenite and chalcopyrite were visually identified in the sample from the largest pod. Neither gold nor silver were detected in any of the samples including one stream sediment sample from the east side of the valley.

Meigs Peak gold-zinc anomaly

Anomalous gold and zinc were found in a 4-mile long stream that originates one-half mile east of Meigs Peak on the Snettisham Peninsula. Seventeen stream sediment samples were taken along 1-3/4 mile of the stream in an attempt to locate the source (fig. 77). Nine of the samples

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Figure 77 near here.

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contained 0.5 to 5 ppm silver, two 0.15 and 0.70 ppm gold, thirteen 200 to 400 ppm zinc, and two 20 and 140 ppm lead (table 37). The anomalous

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TABLE 37 NEAR HERE.

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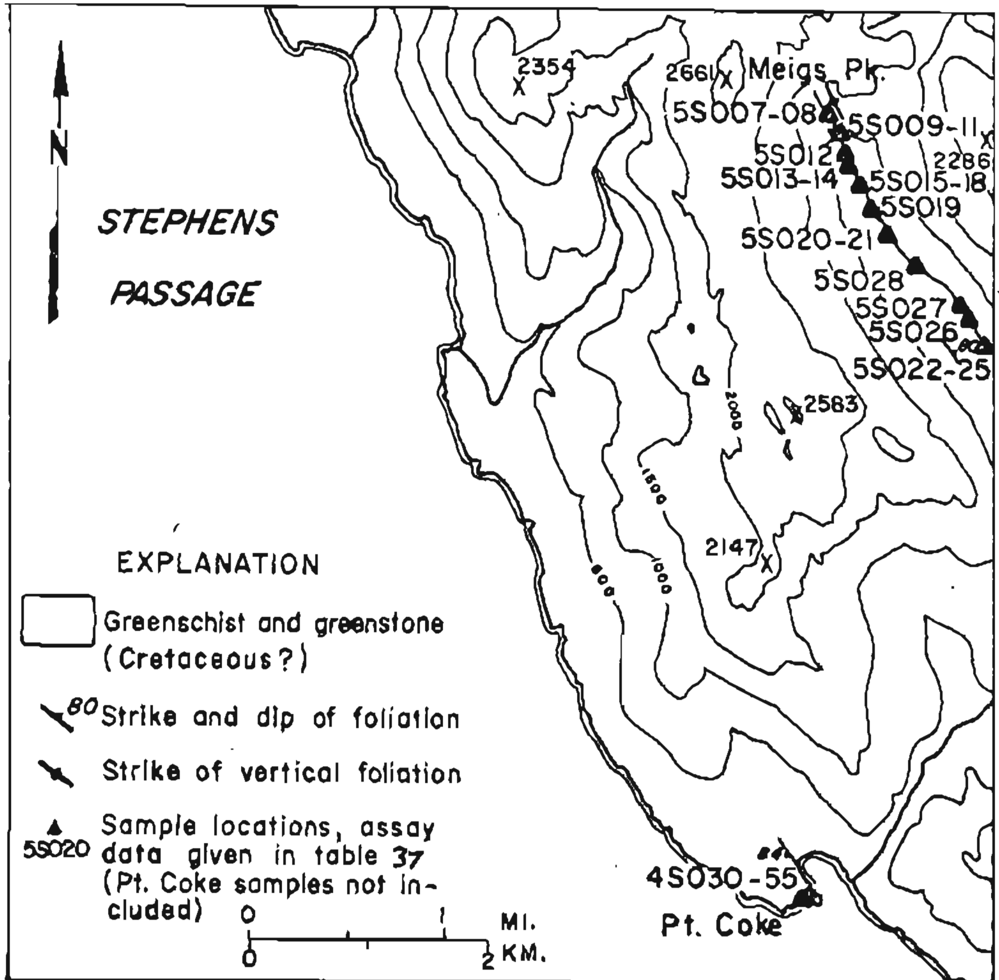
samples were not grouped in a way that would indicate a possible bedrock source. Two rock samples, one taken of a quartz stringer zone penetrating schist containing disseminated pyrrhotite and the other of a quartz vein, contained no significant metals.

Beach quartz

About 2-1/4 miles southeast from Rock Point on Endicott Arm, a prominent quartz lense outcrops on the beach. There is no record of claims being located in the area. Several channel samples were taken of this lense and a 3.5-foot long channel sample of the phyllite wall rock contained 0.15 ppm gold. The location of the samples is shown on plate 3, location M-7.

Table 37.--Assay data, Meigs Peak gold-zinc anomaly.

Sample	Type	Length Ft.	Length (cm.)	Semiquantitative Spectrographic Analysis ppm Ag	Atomic Absorption ppm Au	Cu	Pb	Zn	Description
5S007	Stream sediment	-	-	0.7	N	110	15	140	
5S008	Channel	0.3	(9)	N	N	110	140	30	Schist with disseminated sulfides.
5S009	Stream sediment	-	-	0.7	N	120	10	160	
5S010	do.	-	-	0.5	N	40	10	320	
5S011	Selected grab	-	-	N	N	25	10	75	Iron-stained quartz vein.
5S012	Stream sediment	-	-	0.5	0.15	70	15	260	
5S013	do.	-	-	N	N	100	20	120	
5S014	do.	-	-	0.7	N	65	10	300	
5S015	do.	-	-	N	N	140	15	400	
5S016	do.	-	-	0.5	N	75	10	260	
5S017	do.	-	-	N	N	130	15	380	
5S018	do.	-	-	0.5	N	85	10	280	
5S019	do.	-	-	N	0.7	120	10	230	
5S020	do.	-	-	L	N	120	15	230	
5S021	do.	-	-	L	N	90	10	240	
5S022	do.	-	-	0.5	N	80	10	220	
5S023	do.	-	-	L	N	90	10	250	
5S024	Channel	.2	(6)	N	N	15	15	5	Quartz vein.
5S025	Stream sediment	-	-	2	N	95	10	160	
5S026	do.	-	-	5	N	85	15	270	
5S027	do.	-	-	N	N	75	10	250	
5S028	do.	-	-	N	N	85	10	250	



Base from U. S. Geological Survey 1:63,360 Sumdum D-6 1951

Figure 77.-- Meigs Peak gold-zinc anomaly and Pt. Coke area, sample locations

Figure 77.--Meigs Peak gold-zinc anomaly and Point Coke area, sample locations.

Miscellaneous commodities

Geothermal resources

Geothermal energy potential is conveniently subdivided into three types: hydrothermal convection systems or hot springs; hot igneous (usually volcanic) systems; and conduction-dominated areas (White and Williams, 1975). Six hot springs have been identified on Chichagof Island to the west and three more at least 150 km to the south at Bell Island Hot Springs (Renner, White, and Williams, 1975). No hot spring has ever been identified in the Tracy Arm-Fords Terror study area (Waring, 1917; Miller, 1973), and the density of our work indicates the extreme unlikelihood of any of substantial size. There are no areas of recent volcanic rocks identified in the area nor any possibility that an area large enough to sustain a hot igneous system could have escaped notice. The possibility for an area in southeastern Alaska with a high enough heat flow to produce an energy source has not been fully assessed. There is no indication that such is present and in any event, the technology for utilizing it does not now exist (Nathenson and Muffler, 1975).

Oil, gas and coal

The Tracy Arm-Fords Terror study area has never produced oil, gas or coal nor is it likely to. The metamorphic and batholithic rocks of which the study area consists provide a highly unlikely environment for the accumulation of any of these commodities. Generally, oil, gas and coal occur in young, unmetamorphosed sedimentary basins; there is no possibility that such rocks occur in the study area. Southeastern Alaska has only a few potentially petroliferous basins (Miller, Payne and Gryc, 1959) which are small and have generated little interest from industry. Those basins lie along the western side of southeastern Alaska; the Coast Range batholithic complex and adjacent areas are even of lesser potential to the point of being almost non-existent. Similarly, coal is present in only a few scattered localities along the western side of southeastern Alaska and none of these have quantifiable resource value (Barnes, 1967). The Tracy Arm-Fords Terror area and the rest of the Coast Range complex has no reported occurrence of coal nor any rocks likely to contain it.

Industrial minerals

No industrial minerals have ever been mined from the Tracy Arm-Fords Terror study area. It has never produced abrasives, barite, clays, evaporites and brines, kyanite, phosphates, silica sand or zeolites nor does the geology indicate any likelihood of their presence. Feldspar and mica are present in enormous quantity as rock-forming minerals but the area lacks the kinds of pegmatites with which economic concentrations of these commodities are invariably associated. Asbestos and talc occur in minor quantity in the ultramafic bodies. There are large areas of marble; however, these areas are inaccessible and there is no local market for the stone. Sand and gravel are present in large quantity in the area, but there is no market for this commodity in this remote area. Similarly, dimension stone or crushed rock is present in almost unlimited quantity but no market exists for these commodities.

Nuclear fuels

There has been no production of uranium or thorium from the study area nor are there any significant prospects for future production. The single known radioactive occurrence is the previously discussed BBH #1 prospect where limited exposures of a pegmatitic phase of the batholithic complex contains up to 90 ppm equivalent uranium. This prospect is clearly subeconomic as now known. As discussed under "geochemistry", geochemical sampling of the study area for uranium and thorium was not exhaustive but the values indicate little more than locally high background of those elements throughout the rocks of the area.

The major uranium and thorium deposits of the world occur in peneconcordant deposits in sandstone lenses interbedded with mudstones, e.g., the Colorado Plateau type, or in Precambrian quartz-pebble conglomerates (Finch and others, 1973). Neither type of rocks occur in the study area. Major resources also occur in uraniferous phosphatic rocks and black shales; both are lacking in the study area. Minor amounts of uranium have been produced from vein deposits and uraniferous igneous rocks; the geology of the study area is favorable to these types of deposits although there is no geochemical or occurrence data that suggests their presence.

The potential for significant uranium or thorium mineralization in the area is unlikely.

Tin, tungsten, beryllium and bismuth

Although tin, tungsten, beryllium and bismuth occur in diverse types of deposits, their most common association is with granites or rhyolites. The study area contains extensive areas of Tertiary granite; however, the geochemical data provides only a few barely anomalous analyses of tin, tungsten, beryllium and bismuth. Geologically, their absence may be explained by the mesozonal character of the Tertiary granite. If tin, tungsten, beryllium and bismuth deposits were associated with these granites, they probably would occur near their apical zones where the bodies intruded their host rocks. These zones have since been eroded away as the mesozonal portion of the plutons have been exposed.

Evaluation of mineral resources

by

Donald Grybeck, Arthur L. Kimball, David A. Brew, and Jan C. Still

Introduction

This evaluation of the mineral resources of the Tracy Arm-Fords Terror Wilderness Study Area synthesizes the geology, geochemistry, geophysics, individual deposit evaluation, production, and exploration history, and also includes economic constraints which limit mining of the resources.

The whole study area consists of two parts separated by a northwest-trending line which is drawn generally along the western edge of a foliated tonalite sill; to the northeast of the line is the Coast Range batholithic complex and to the southwest is the western metamorphic belt. The Coast Range batholithic complex consists of granitic bodies of varying size, shape, composition, and age together with high-grade gneiss, schist, and marble country rock, all of which appear to have low mineral resource potential. The western metamorphic belt consists of low- to high-grade metamorphic rocks with local hypabyssal intrusions and ultramafic masses; it contains almost all of the mineralization known prior to (and as a result of) this study.

Coast Range batholithic complex

The batholithic rocks are well exposed where not covered by glaciers or water; nearly vertical, fresh exposures up to 910 m (3,000 feet) high are common and the relief often presents panoramic views of miles of outcrop. As part of the systematic geologic mapping and geochemical sampling, many miles of outcrop were traversed on foot. In addition, many areas of outcrop were examined from the air by helicopter either closely or in the course of moving from point to point. It is unlikely that a large outcropping mineral deposit would have escaped notice. Smaller mineral deposits, however, may have escaped notice because the density of the geologic coverage and geochemical sampling was not sufficient to identify them. The mineralization known in nearby parts of the complex in both Alaska and Canada does not suggest significant mineralization within the study area.

The pendants and screens of metamorphic rocks of the complex are more likely hosts for mineral deposits than are the granitic rocks. The metamorphics are markedly heterogeneous and intricately deformed; but small epigenetic or stratabound deposits could occur. The marble and calc silicate rocks suggest the possibility of contact metamorphic copper, iron or tungsten deposits. However, the Whiting River silver prospect is the only deposit known within the metamorphic rocks.

In contrast to the metamorphics, the granitic plutonic rocks of the complex are homogeneous over wide areas and their mesozonal textures suggest that erosion has destroyed any mineralization that may have been present in their apical zones.

Prominent reddish orange-brown stained zones occur in both the metamorphic and plutonic rocks of the batholithic complex; they range in size from a few feet to a mile in diameter; most are less than a hundred feet across. Their general appearance suggests metallic mineralization, but close examination and detailed sampling indicate that the color is a surface phenomena due to the alteration of iron in biotite and in sparsely disseminated iron sulfides to a coating of "limonite" or goethite. The zones locally cross geologic contacts and occur near the termini of glaciers. Many stained zones occur in areas of present-day glacial run-off and in the run-off areas of the more extensive and thicker glaciers of the recent geologic past.

The potential for economic mineralization in the ultramafic rocks of the Coast Range complex is low. The bodies are small, discontinuous, and located in inaccessible areas. They are high in cobalt, chromium, nickel, and platinum-group metals compared to the other rocks in the study area, but the values reflect the normal abundance of these metals in ultramafic rocks. Only trace amounts of asbestos minerals were observed.

Western metamorphic belt

The western metamorphic belt has been recognized as having significant mineral potential since the early 1900's, when the Juneau gold belt was recognized within it. Many of the occurrences investigated and reported on here have been known since that time or earlier. These include the Point Astley zinc-silver deposit, the Sumdum Chief gold deposit, the Spruce Creek lodes near Windham Bay, the Sulphide and Holkam Bay claim groups. The present study has identified two areas of mineral-resource potential within the western metamorphic belt within the study area; these are, in order of decreasing importance, 1) the Sumdum Glacier mineral belt, and 2) the Endicott Peninsula.

Although not discussed further, the remainder of the western metamorphic belt in the study area also has some potential for the occurrence of mineral deposits. This is based on 1) proximity to areas with recognized potential, 2) similarity of lithologies throughout the western metamorphic belt, and 3) generally high metal content as indicated by the number of anomalous stream sediment samples. The whole belt is largely covered with heavy timber and brush.

Sumdum Glacier mineral belt

The Sumdum Glacier mineral belt extends for about 52 km (32 miles) along the Coast Range batholithic complex and contains the greatest number of metallic mineral resource occurrences in the study area. The belt is about 0.3 to 1.6 km (0.2 to 1.0 miles) wide with a clearly defined northeast boundary to the mineralization at the edge of the batholithic complex. The three deposits that have economic potential and warrant further exploration are the Sweetheart Ridge mineralized zone gold-copper occurrence, the Tracy Arm zinc-copper prospect, and the Sumdum copper-zinc prospect (fig. 1). Of the three, the Tracy Arm zinc-copper prospect has the best potential and is likely to attract commercial interest. The data for the Sumdum copper-zinc prospect and the Sweetheart Ridge mineralized zone are less complete, but geologic conditions indicate the possibility of greater tonnage than for the Tracy Arm zinc-copper deposit.

The deposits of the belt are mostly lenses and pods of copper- and zinc-bearing minerals parallel the foliation of the metamorphic rocks. Deposits at the northern end of the mineral belt have substantial gold values. All the deposits have been metamorphosed and the ore minerals--chalcopyrite and sphalerite with subordinate pyrite, minor galena, and gold--occur both as disseminated grains in the metamorphic rocks as well as in the lenses and pods. The pre-metamorphic history of the deposits is uncertain, but they probably were syngenetic or volcanogenic deposits. A volcanogenic origin is more likely in light of the gold-copper-zinc association and the thick volcanic sequences in the western metamorphic belt.

The Tracy Arm zinc-copper deposit consists of nearly vertically dipping banded sulfides from .6 to 3 m (2 to 10 feet) in width that have been traced through outcrops and pits for 350 m (1,150 feet) along strike. Assuming continuity of grade and width downward as well as between the exposures sampled, and a depth equal to one-half of the strike length, the deposit is calculated to contain 169,600 metric tons (187,000 tons) of inferred ore, with an average mining width of 1.58 m (5.2 feet) and averaging 3.42 percent zinc, 1.42 percent copper, 15 g/metric ton (0.43 oz/ton) silver and 0.27 g/metric ton (0.008 oz/ton) gold along a 259 m (850 feet) strike length. At February 1976 prices, the gross in place value of the Tracy Arm zinc-copper prospect, as now known, probably lies between $1,000,000 and $10,000,000.

The Sumdum copper-zinc deposit consists of massive and disseminated sulfides exposed in two steeply dipping parallel zones 0.3 to 15 m (1 to 50 feet) thick that more or less parallel the foliation in the country rock. The zones are interpreted to be along the crest and flanks of a nearly isoclinal fold. If the zones are continuous beneath mile-wide Sumdum Glacier, they have a strike length of about 3,050 m (10,000 feet). Assuming continuity of grade and width between sampled intercepts in diamond drill holes and surface open cuts, and based on a 2,700 m (9,000 foot) strike length with an average width of 9.6 m (31.4 feet) to an estimated depth of 305 m (1,000 feet); the deposit is calculated to contain 24.2 million metric tons (26.7 million tons) of inferred ore containing 0.57 percent copper, 0.37 percent zinc, and 10.3 g/per metric ton (0.30 ounces per ton) silver.

The Sweetheart Ridge gold-copper deposit consists of a mineralized zone up to 60 m (200 feet) wide that has been sampled for 600 m (2,000 feet) along strike. A 1.68-m- (5.5-foot-) wide by 44.8-m- (147-foot-) long portion of the zone averaged 8 g/metric ton (0.23 oz/ton) gold and 0.7 percent copper. This section to an established depth of 30.5 m (100 feet) contains 6,600 metric tons (7,300 tons) of inferred ore. Samples of the remainder of the mineralized zone contain copper from 0.1 to 2 percent, gold up to 0.9 g/per metric ton (0.026 ounces per ton) and silver up to 20.9 g/per metric ton (0.609 ounces per ton). The topographic depression which this mineralized zone follows can be traced for 9 km (5-1/2 miles). This depression is unexplored and may indicate the actual extent of the mineralization.

Although the three prospects described above have the greatest economic mineral potential, the entire 52 km (32 mile) length of the Sumdum Glacier mineral belt is favorable for the occurrence of mineral deposits. A simple statistical approach has been used to model the mineral resource potential of the belt. It considers the history of mineral exploration in the belt, the number of known significant prospects and their approximate size and value, and it then estimates the numbers and sizes of possible additional prospects of similar significance that may be undiscovered. This is a non-predictive model and is intended only to convey a general idea of what may be present in the belt.

The history of discovery of the three major deposits in the area provides a background for judging the effectiveness of our study and of mineral exploration in the area. The Sumdum copper-zinc deposit was not found until 1958 despite almost a century of prospecting in the general area; it is well exposed and would have been found during this study. Tracy Arm zinc-copper prospect, found in 1916, is largely concealed and it is doubtful that it would have been found during this study. The 610-m- (2,000 feet-) long Sweetheart Ridge mineralized zone is above timber line and was first indicated during this study as the result of an anomalous rock geochemical sample collected in 1973. Follow up of that sample and a search for old claims lead to the identification of the 610-m-long zone in 1974. Similar mineralized zones that are covered by talus or vegetation could go undetected. None of these three deposits were directly detectible from the stream sediment geochemical information obtained during the study.

Considering this exploration history and the terrain characteristics, it is estimated that about 20 percent of the whole belt (fig. 1) has been examined thoroughly enough to find any deposit similar in size to the three known major deposits and exposed on the surface. If the remaining 80 percent of the belt has a similar deposit density, it is probable that there may be 12 more deposits with similar tonnage, grade and potential in the area. Those 12 could include some of the already-known but relatively unexplored deposits in the mineral belt; some of these could have the same or better potential than the three major deposits. It is important to note that 1) there may be only those three deposits which have already been found, and 2) that 15 is not necessarily an upper limit. This simple model does not consider non-outcropping deposits which could not be discovered by surface explorations.

Using the U.S. Bureau of Mines-U.S. Geological Survey mineral resource classification terms (U.S. Bureau of Mines and U.S. Geological Survey, 1976), the authors estimate that the belt contains the following gross in-place values of metallic mineral resources: $15 million of identified paramarginal resources, $325 million of identified submarginal resources, and it may also contain $120 million of hypothetical resources. The first two figures are based on the three known deposits and the last figure is based on the assumption that most of the undiscovered deposits are in the $1 million-$10 million range.

In summary, the Sumdum Glacier mineral belt is an attractive target for exploration and possible development. There are three known deposits with a combination of tonnage, grade, and potential that give them individual gross in-place values in excess of $1,000,000. All three are potentially minable. A simple model suggests there may be as many as 12 more deposits of at least comparable value which may be discoverable with more surface exploration. Some of these deposits could be larger than the three known major deposits, one of which, the Sumdum copper-zinc prospect, contains over 24 million metric tons (26 million tons) of inferred ore. It is possible that deposits of similar size are concealed at depth in the mineral belt. Finding either exposed or concealed deposits is likely to be difficult and expensive.

Endicott Peninsula area

The broad Endicott Peninsula area (fig. 1) has been prospected since before 1869 and several occurrences have long been known; namely, the Point Astley zinc-silver deposit, the Sumdum Chief gold mine, the Taylor Lake area prospects, the Holkham Bay gold prospect, and the Windham Bay area gold lodes and placers. The deposits in the area are largely either sulfide minerals disseminated through or in lenses and stringers along the foliation in bleached and altered zones in phyllite- or gold-bearing quartz veins in shaly limestone, limy slate, or phyllite. The area as a whole is poorly exposed because of extensive timber and brush.

The Sumdum Chief mine located about 3 km (2 miles) south of Sanford Cove was the major mine in the area; between 1895 and 1904 it produced about 24,000 ounces of gold from ore that averaged about 14 g/metric ton (0.4 oz/ton) gold. This is equivalent to about 54,400 metric tons (60,000 tons) of ore containing $62 per metric ton($56 per ton) recoverable gold at February 1976 prices. The mine is reported to be mined out. The features of the deposit are obscure because the workings are caved at the main haulage portal and the mine has been inactive since 1905. However, the vein is exposed near the top of an old stope 300 m (1,000 feet) above the main haulage level; there, mineralization consists of persistent gold quartz veins containing pyrite and base metal sulfides in a gray graphitic limestone. Gold-bearing quartz veins with similar mineralogy and host rock occur at the Bluebird prospect 6 km (4 miles) to the south but no production has been reported.

A number of lode and placer gold mines and prospects occur near the head of Windham Bay. None had more than minor production and all are similar geologically: the mineralization occurs in irregular quartz veins and stringers both parallel to and cross-cutting the foliation of the low-grade metamorphic rocks. The gold content of veins rarely exceeds 9 g/metric ton (0.25 oz/ton) and sulfides are sparse. The metal values of the ore are too low to be mined economically.

The area between the Sumdum Chief mine and Taylor Lake, which is north of the head of Windham Bay, is of particular exploration interest. As already noted, the Sumdum Chief was an important gold deposit and the Taylor Lake area has a similar geological setting and large sulfide-bearing quartz veins with some gold values.

The Point Astley prospect at the northwest end of the Endicott Peninsula has been known since the turn of the century but has had little development. The deposit consists of disseminated pyrite and sphalerite with lesser amounts of galena and copper sulfides in altered muscovite-quartz-feldspar schist. Locally, the sulfides form lenses less than 0.9 m (3 feet) in length and usually less than 0.3 m (1 foot) wide. The mineralization occurs in a broad irregular altered zone (or zones) a few hundred meters in strike length.

The geology of the Endicott Peninsula is favorable for the occurrence of metallic mineral deposits of different types. The thick metavolcanic section has a relatively high metal content as shown by geochemical sampling and suggests the possibility of volcanogenic deposits. In addition, small hypabyssal intrusives are scattered through the peninsula.

In summary, the Endicott Peninsula area is favorable for the occurrence of mineral deposits. The one known significant deposit, the Sumdum Chief gold mine (were it not mined out) 1) would be a likely exploration and development target, 2) contained a gross in place metal value between $1 and $10 million at 1976 prices, and 3) would probably be minable under present economic conditions.

The Sumdum Chief veins were not detected by geochemical sampling and probably would not have been found by our study. It is doubtful that even 10 percent of the exposed rock accessible above the shoreline has been examined in enough detail to exclude it from the possibility of significant mineralization. Favorable geology and a history of significant production make this large and little-explored area favorable for the discovery of significant new deposits, but exploration is likely to be difficult and expensive.

Windham Bay ultramafic area

The Windham Bay ultramafic body belongs to the belt of "Alaska-type" ultramafics which extends through southeastern Alaska; some bodies in this belt are potential sources for iron, copper, nickel, and platinum group metals. The body consists of hornblendite, biotite, pyroxenite, and diorite discontinuously exposed along the shores of Windham Bay. It is associated with a moderately strong positive magnetic anomaly (plate 1) that indicates some similarity to the Snettisham body about 48 km (30 miles) to the northwest. The Snettisham body has been extensively drilled and is now considered a potential iron mine. However, aeromagnetic interpretation suggests that the Windham Bay body probably does not contain significant amounts of magnetite. Sampling of its limited exposures indicates roughly 4 percent magnetically recoverable iron which is too low to be economic. Little more than geochemical background amounts of copper and nickel were found.

The aeromagnetic survey (plate 2) indicates that there are no additional major ultramafic bodies in the study area between the Snettisham and Windham Bay bodies.

Porphyry copper and stockwork molybdenum deposits

The probability of the occurrence of porphyry copper or stockwork molybdenum deposits in the study areas appears to be low. The Coast Range batholithic complex apparently lacks stockworks, zones of argillic alteration, or shallow intrusives. Rock and available stream sediment geochemistry did not suggest any such mineralization. However, the recent discovery of an apparently major molybdenite occurrence in the Coast Range complex east of Ketchikan (R. L. Elliott, oral commun.) may stimulate exploration for this type of deposit in the complex and adjacent rocks. The western metamorphic belt rocks are geologically more favorable than the Coast Range complex for porphyry copper or stockwork molybdenum deposits but no such mineralization was found nor was any geochemical evidence for such deposits.

Gold placers and radioactive minerals

At least 2,000 ounces of gold were reported produced from the Windham Bay area [probably from Spruce Creek] and Powers Creek (Spencer, 1906). Other placer gold probably was produced. It is doubtful if any significant amount of auriferous gravels remains. Placers of any kind are highly unlikely in most of the area because of the effects of glaciation.

The potential for economic concentrations of radioactive minerals appears to be low. Rocks comparable to the uranium-bearing conglomerates or sandstones found elsewhere in the world are totally absent. Alkalic rocks, which are often associated with uranium deposits, are lacking. The large volume of granitic rocks in the study area suggests the possibility of vein or disseminated uranium or thorium deposits, but only a few samples with radioactivity about twice background were collected from several very small pegmatite bodies at one prospect.

Conclusion

The above descriptions of the areas favorable for the occurrence of metallic mineral deposits in the Tracy Arm-Fords Terror Wilderness Study Area indicate that the western part of the area has significant potential for gold, copper, zinc, and silver. Three known deposits deserve serious exploration. Other significant deposits are probably present, but their discovery is likely to require extensive exploration.

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