STUDIES RELATED TO WILDERNESS

TRACY ARM–FORDS TERROR AREA, ALASKA

U.S. GEOLOGICAL SURVEY BULLETIN 1525

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

FRONTISPIECE.—Oblique aerial photograph looking east toward the head of Tracy Arm.

Mineral Resources of the Tracy Arm–Fords Terror Wilderness Study Area and Vicinity, Alaska

By U.S. GEOLOGICAL SURVEY *and* U.S. BUREAU OF MINES

A. Geology of the Tracy Arm–Fords Terror wilderness study area and vicinity, Alaska
B. Interpretation of the aeromagnetic data
C. Interpretation of the available gravity data
D. Geochemistry of the Tracy Arm–Fords Terror wilderness study area and vicinity, Alaska
E. Mineral deposits and occurrences in the Tracy Arm–Fords Terror wilderness study area and vicinity, Alaska
F. Evaluation of mineral resources

STUDIES RELATED TO WILDERNESS

GEOLOGICAL SURVEY BULLETIN 1525

An evaluation of the mineral potential of the area.

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STUDIES RELATED TO WILDERNESS

WILDERNESS 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 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

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

SUMMARY

By DAVID A. BREW, ARTHUR L. KIMBALL, DONALD GRYBECK, and JAN C. STILL, U.S. GEOLOGICAL SURVEY and U.S. BUREAU OF MINES

The wilderness study area consists of about 322,300 hectares (1,250 mi^2 or 796,400 acres) on the southwest side of Coast Range in southeastern Alaska, about 72 km (45 miles) southeast of Juneau, Alaska (fig. 1). An additional area of 142,800 hectares (550 mi^2 or 352,900 acres) lying in part between the study area and the international boundary and in part contiguous to the southwest of the study area was studied because of its 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 up to 2,470 m (8,095 ft) high, tidewater glaciers, icebergs, and some broad river valleys. There are no roads or maintained trails or permanent residents; access is only by specially arranged water or air transport. Present human use of the area is related to recreation or mineral exploration.

This report presents pertinent geologic, 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 synthesizes this information to evaluate the mineral resources 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

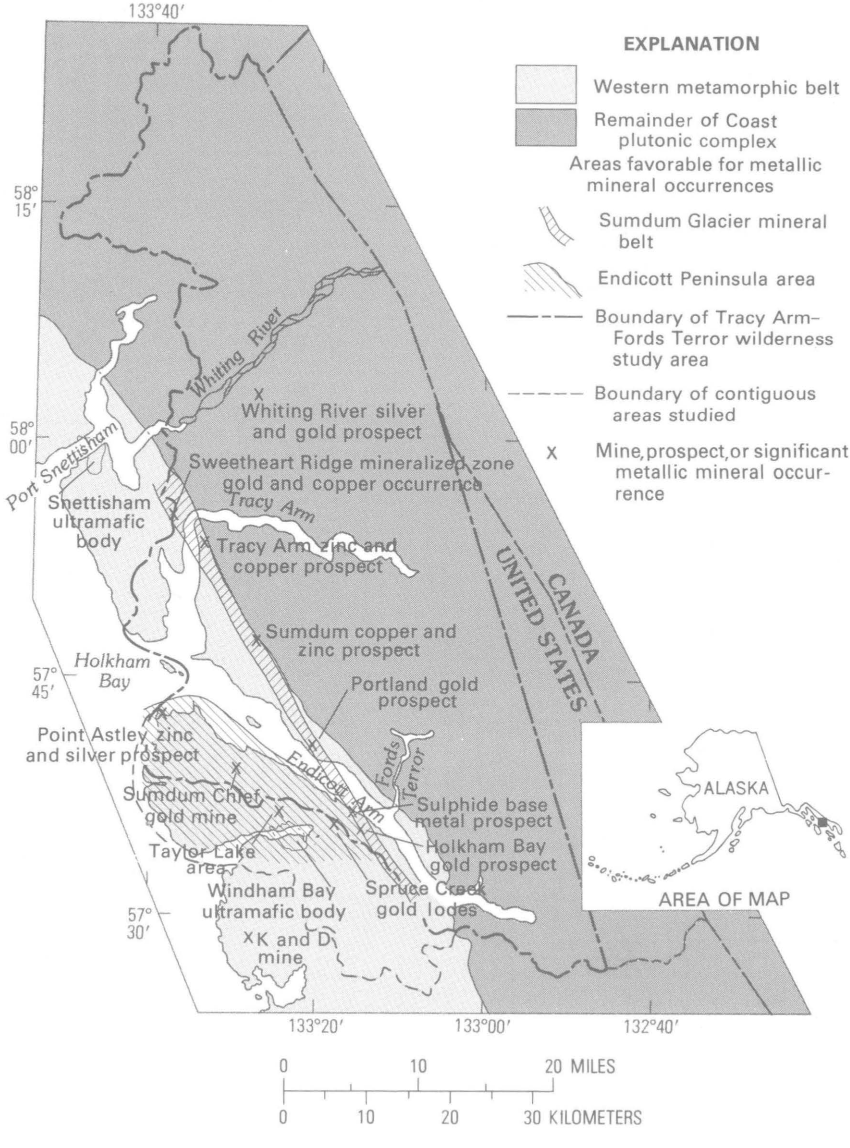

FIGURE 1.—Tracy Arm–Fords Terror wilderness study area, southeastern Alaska, showing western metamorphic belt, the rest of the Coast plutonic complex, major known metallic mineral occurrences, and areas favorable for metallic mineral occurrences.

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 a search of mining claim records; 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 1.5 km (1 mi) were sampled, 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 680,400 g (24,000 oz) 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 plutonic complex. Little significant mineralization appears to be present in the complex itself.

The western metamorphic belt has been recognized as having significant mineral resources 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 with important gold, copper, zinc, and silver resources 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 resources.

The Sumdum Glacier mineral belt extends for about 52 km (32 mi) along the southwest side of the Coast plutonic 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 to the foliation or disseminated in the metamorphic rocks.

These three deposits warrant futher exploration as they have economic potential. 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 per metric ton (0.43 oz per ton) silver, and 0.27 g per metric ton (0.008 oz per 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 per metric ton (0.30 oz per ton) silver. A 44.8-m-long (147-ft) 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 ft) of depth that averages 7.8 g per metric ton (0.23 oz 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. The available information is used to arrive at a range for the number of significant deposits that are probable in the belt and to estimate the range of total gross in-place value probable in the belt.

The three known deposits indicate the minimum number of significant deposits in the belt and the lower limits of size, grade, and other parameters that are likely to attract serious attention from prospective developers. That is, deposits that are smaller, of lower grade, less minable, or of lesser gross value are not likely to be attractive.

We estimate that, owing 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 are 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 between 3 and 15 deposits are of at least minimum attractive size and value. Note, however, that there may be no more than the 3 that have been found and that 15 is not necessarily the upper limit. The other 12 could include some of the already-known but relatively unexplored deposits in the belt. This estimate does not include non-outcropping deposits.

Using the accepted U.S. Bureau of Mines–U.S. Geological Survey mineral resources classification terms, we estimate that the belt contains the following gross in-place values of metallic mineral resources (February 1976 prices): $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 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 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 680,400 g (24,000 oz) of gold from ore with about 13.6 g per metric ton (0.4 oz per ton) gold. The other prospects and mines either had no production or practically none. The Taylor Lake occurrences are geologically similar to the Sumdum Chief gold mine. 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 along quartz stringers in broad altered zones, and all appear to have low gold contents that only rarely exceed 9 g per metric ton (0.25 oz per ton). The Holkham Bay prospect is similar and had some small production. None of these deposits appears 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 plutonic complex. The area is divided along a north-northwest line by a long foliated tonalite sill of Cretaceous or Tertiary age (fig. 1). The main part of the complex lies to the northeast of the sill and consists of a broad terrane of complexly deformed amphibolite-facies gneiss, marble, and some schist of uncertain, but probable late Paleozoic and (or) Mesozoic protolithic age. Near the International Boundary this terrane is intruded by a series of generally unfoliated granodiorite bodies of Tertiary age which are locally associated with zones of migmatite.

To the southwest of the sill is the western metamorphic belt, which is also part of the Coast plutonic complex and which consists of metamorphic rocks that 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 rocks. The Sumdum Glacier mineral belt is largely within these rocks. To the southwest the metamorphic grade decreases 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 protolithic ages of these metamorphosed 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, is a 3- to 13-km-wide (2 to 8 miles) zone of closely spaced prominent joints, foliation surfaces, and small faults that roughly parallels the tonalite sill and the north-northwest-striking foliation along lower Tracy Arm and lower Endicott Arm where they join Holkham Bay. The other, the northeast-trending Whiting River–Sweetheart Lake lineament, consists of two near-parallel northeast-striking lineaments extending from the Snettisham Peninsula up the Whiting River to the near the international boundary (fig. 1). 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 as do most of the metamorphic rocks and migmatite of the rest of Coast plutonic complex.

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 the area studied. Comparison of the similarly shaped Port Snettisham and Windham Bay anomalies shows a significant difference in amplitude caused by the considerably lesser amount 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 to within about 700 m (2,300 ft) of the surface at its shallowest point.

A discontinuous magnetic high, associated with the tonalite sill, causes a steep magnetic gradient between the western metamorphic belt and the rest of 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 tonalite sill. 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 KIMBALL,
U.S. GEOLOGICAL SURVEY and U.S. BUREAU OF MINES

The Tracy Arm–Fords Terror wilderness study area covers about 322,300 hectares (1,250 mi^2 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 resources of the study area proper and of an adjacent 142,800 hectares (550 mi^2 or 352,900 acres). Some 44,000 hectares (170 mi^2 or 109,090 acres) of this adjacent area lie between the National Forest lands of the study area and the International Boundary; the remaining area lies 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 chapters of this report use metric and English units in different ways. All chapters written solely by U.S. Bureau of Mines authors use English units only. All chapters written either solely or jointly by U.S. Geological Survey authors or jointly by them and the Bureau of Mines authors use metric units with English units following in parentheses.

ACCESS, USE, AND GENERAL CHARACTER

The study area (fig. 1) is about 72 km (45 mi) 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 a 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 rainstorm 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 mi) 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 or 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 tens 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 were acquired by individuals who may intend to develop recreational homesites.

The Tracy Arm–Fords Terror area, as a whole, is very scenic (figs. 2, 3). 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.

In terms of the actual relief, the maximum in the area is between the unnamed 2,470-m (8,100-ft) peak rising from the South Sawyer Glacier Névé and tidewater at the terminus of the Dawes Glacier, about 12.9 km (8 mi) distant. High local relief occurs near the head of Fords Terror where a peak 1,835 m (6,020 ft) high occurs within 3.2 km (2 mi) of tidewater and also near the head of the Tracy Arm, where only 3.6 km (2.25 mi) separate tidewater at Sawyer Glacier terminus from an unnamed peak with a elevation of about 2,150 m (about 7,050 ft).

FIGURE 2.—Oblique aerial photograph looking east across Sumdum Glacier.

FIGURE 3.—Oblique aerial photograph looking north at the Narrows in Fords Terror.

PREVIOUS STUDIES

Little was known of the regional geology of the study area before 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, 1979); and Beikman (1974). The only published geophysical information covering the area is the gravity study reported by Barnes (1972a, b, c, d), by Barnes, Olsen, Holden, Morin, and Erwin (1972), and by Barnes, Popenoe, Olsen, MacKenzie, and Morin (1972).

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

General discussions of mineral-resource potential in this part of southeastern Alaska are given by Buddington and Chaplin (1929), Noel (1966), Harris (1968), U.S. Geological Survey (1969), and Clark, Berg, Cobb, Eberlein, MacKevett, and Miller (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 (1925, 1927), 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 of the 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 a unpublished report by R. H. Seraphim in 1959 and the later studies by MacKevett and Blake (1964).

Other early work on specific properties includes 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 was reported on by Kloss (no date (probably 1941)).

A prospectus-type report on the Point Astley prospect was written by Ahrestedt (1927). The lodes on upper Spruce Creek were examined in 1915 by B. L. Thane of the Alaska-Gastineau Mining Company, and a report on the Windham Bay Gold Mining Company lodes (Marty Mines) was prepared by Willis (1926). The same properties were examined by J. A. Williams (1938) 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. RV *Don J. Miller II* using small boats and cooperatively shared contract helicopter support.

Investigations by the Geological Survey included review of earlier studies before 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 1974. 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 1975. In total, 51 person-months were spent in the field.

The Geological Survey fieldwork had four main components: reconnaissance geological 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-mi) 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 that 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-sediments sampling experiment are reported by Johnson, Forn, Hoffman, Brew, and Nutt (1980) and those of the bedrock experiment of Hoffman, Brew, Forn, and Johnson (1980).

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 that could be found in the study area. In addition, stained or altered zones and geochemically anomalous sites identified during this study were investigated. These investigations 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 R/V *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. In total, 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 geochemcial, petrographic, and quantitative. The geochemical samples were used primarily to determine the relative abundance of metals and other elements in specific rock units; the petrographic samples were used to determine mineralogy, rock type, and genesis; and the quantitative samples were used 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, and so on, as the midpoints of the intervals. In a comprehensive study of the precision of the spectrographic method Motooka and Grimes (1977) 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 iron, magnesium, calcium, and titanium which are reported in percentages. Where especially high values are discussed in the text, the values in parts per million may be followed with percentages in parentheses (%); gold and silver, however, are expressed in troy ounces per ton. Table 1 provides the conversions for parts per million, percentage, and ounces per ton. (All tables follow the text, beginning on p. 225).

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 after the 1973 and 1974 field seasons. Analysts in 1974 were R. W. Leinz, R. B. Carten, D. Siems, and J. Abrams, and sample preparation was done mainly by T. Horkan. Analysts in 1974 were C. L. Forn and J. D. Hoffman, and preparation was done 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 C. L. Forn and J. D. Hoffman; Geological Survey sample preparation was done by P. R. Johnson and Bureau of Mines preparation by G. Mills.

Duplicate atomic absorption determinations were made in the Bureau of Mines laboratory at 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 W. L. 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.

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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. Technicial review of this report was graciously provided by J. G. Smith and R. A. Loney.

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Geology of the Tracy Arm–Fords Terror Wilderness Study Area and Vicinity, Alaska

By DAVID A. BREW and DONALD GRYBECK,
U.S. GEOLOGICAL SURVEY

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

GEOLOGICAL SURVEY BULLETIN 1525–A

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GEOLOGIC SETTING

The Tracy Arm–Fords Terror wilderness study area spans the Coast plutonic complex 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 mi) from near the British Columbia–Washington boundary at the 49th parallel on the south to the Yukon Territory–Alaska at longitude 141° W. on the north and ranging in width from about 100 km to 200 km (60–120 mi).

Throughout British Columbia and southeastern Alaska the Coast plutonic complex 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 and 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 protoliths of the metamorphic rocks are late Paleozoic or early Mesozoic in age, with some of middle or late Mesozoic age probably also present; the granitic rocks are middle Mesozoic to middle Cenozoic in age. These regional zones are shown diagrammatically in figure 4.

These four zones are subdivided into seven irregular subzones in the study area (pl. 1). The southwestern four of the subzones are referred to together in this report as the "western metamorphic belt" and correspond to the southwesternmost main zone described above. All but the easternmost of these four subzones consist of low-grade metamorphosed detrital and volcanic rocks of probable late Paleozoic or early Mesozoic age cut by complicated granite, diorite, and

<table>
<tr><td rowspan="2">REGIONAL GEOLOGIC ZONES</td><td colspan="6">SW ←→ NE</td></tr>
<tr><td colspan="2">(1)
Low to intermediate temperature, intermediate high pressure facies series metamorphic rocks with some mesozonal granitic bodies</td><td colspan="2">(2)
Intermediate temperature, intermediate to high pressure facies series metamorphic rocks with some mesozonal granitic bodies</td><td>(3)
Mesozonal to epizonal granitic intrusives with screens and pendants of metamorphic rocks as to SW</td><td>(4)
Low to high temperature, low to imtermediate pressure facies series rocks with some epizonal granitic bodies</td></tr>
<tr><td rowspan="2">LOCAL GEOLOGIC ZONES (OR SUB-ZONES) IN TRACY ARM-FORDS TERROR AREA</td><td colspan="2">Western metamorphic belt</td><td colspan="3">Remainder of Coast plutonic complex</td><td rowspan="2">Not present on U.S. side of International Boundary</td></tr>
<tr><td>(1) (2) (3)
Low grade (prehnite-pumpellyite metagraywacke to greenschist facies) metadetrital and volcanic rocks with granitic intrusions</td><td>(4)
High-grade (amphibolite facies) metamorphic rocks</td><td>(5)
Remarkably long foliated tonalite</td><td>(6)
Broad terrane of gneiss, schist, and marble</td><td>(7)
Granodiorite, granite, and associated migmatite of inferred Tertiary age along International Boundary</td></tr>
</table>

FIGURE 4.—Relations of regional and local geologic zones, map units, mineralized belts and favorable areas, Tracy Arm–Fords Terror wilderness study area, Alaska.

hornblendite intrusions with locally extensive contact-metamorphic effects. The fourth subzone consists of higher grade metamorphic rocks; the protolithic ages of these rocks are uncertain, but they are probably also late Paleozoic or early Mesozoic.

The next two of the seven subzones correspond to the second main zone described above and consist of a remarkably long foliated tonalite sill of inferred Cretaceous or Tertiary age, referred to as the "Coast plutonic complex sill" in this report, and a broad terrane of gneiss, schist, and marble of uncertain protolithic age. The seventh subzone consists of granite and granodiorite bodies of mid-Tertiary age along the international boundary and corresponds to the third main belt.

The northeasternmost of the four main zones is not present in the 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 4.

The western metamorphic belt is part of the Wrangell-Revillagigedo metamorphic belt of Buddington and Chapin (1929) and also includes part of the Juneau Gold Belt of Spencer (1906).

The general lack of information about the protolithic ages 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 subzone, (2) rock type, and (3) age, with different factors emphasized for different units. Distribution of the map units are shown on plate 1 and the names of these units at the appropriate place in the descriptions in the following sections and are shown in relation to regional zones and local subzones in figure 4. It should be noted that all of the nonintrusive map units are metamorphic rock units and more than one map unit may be derived from the same protolithic unit. The correlations suggested in this report provide a means of reconstructing the extent of the protolithic 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 occurrences of high-grade units near intrusions within the low-grade belt.

GREENSCHIST AND GREENSTONE

The greenschist and greenstone map unit occurs in a irregularly shaped belt, 61 km (38 mi) long and 8 km (5 mi) wide, running from the study area boundary to the Snettisham Peninsula 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 the limestone unit. Locally, appreciable quartzite is interlayered with the dominant greenschist and greenstone.

The greenschist and greenstone map unit is mostly comprised of rocks of the 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 greenschist and greenstone map 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 unit are amphibolite as well as biotite and hornblende schist and gneiss.

In more detail, the rocks of the lower grade part of the greenschist and greenstone map unit 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 that 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 part of the greenschist and greenstone map unit are (feldspar)-hornblende amphibolite, biotite schist, actinolite schist, hornblende schist, (biotite)-hornblende gneiss, garnet-(chlorite)-(plagioclase)-hornblende gneiss, and biotite-quartz-feldspar gneiss.

This metamorphic unit appears to be derived from a protolithic assemblage composed of volcanic rocks, carbonaceous shale, limestone, and chert. The latter three rock types are now the dark-gray graphite phyllite, marble, and quartzite. The original nature and composition of the volcanic rocks are uncertain; some of the greenstone and semischist probably were diabase intrusions; some may have been massive flows. At a few localities the greenstone and greenschist contains relict pyroxene phenocyrsts, but this is not typical of the unit. Some of the greenschist and green phyllite contains common to widely scattered ellipsoids up to 20 cm long 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 protolithic age of the greenschist and greenstone unit is not known directly but is inferred to be Permian(?) and Triassic 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 m) to the northwest for a Late Triassic age of dark-gray carbonaceous phyllite and shale like that of the locally intercalated phyllite and slate map unit. The age of metamorphism, as discussed in the structure section of this chapter, is inferred to be Late Cretaceous.

The rocks of this map unit are similar in protolithic composition 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, 1977a) and beyond to the northwest; they are not recognized to the southeast along strike into the Port Houghton area. Permian and Triassic rocks are known on Admiralty Island, about 32 km (20 mi) across regional strike to the west and southwest (Lathram and others, 1965; Loney, 1964), where at least 900 m (3,000 ft) of graywacke, argillite, chert, phyllite, conglomerate, altered pillow lava and breccia, and overlying dolomite of Early Permian age is present. These rocks are overlain unconformably by an indeterminate thickness, probably greater than 790 m (2,600 ft), 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, Holkham 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 chapter D entitled "Geochemistry."

PHYLLITE AND SLATE

The phyllite and slate unit occurs on the Endicott Peninsula mainly 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 Holkham 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 sediment together with fine-grained volcanic sediment or tuff and minor limestone.

In more detail, and using the conventions introduced in the previous section, the common rock types of the phyllite and slate unit 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 protolithic age of the phyllite and slate map unit is not known directly, but it is inferred to be Permian(?) and Triassic(?) on the basis of the same evidence discussed for the greenschist and greenstone map unit. As will be noted, it is possible that some of the southwesternmost outcrops are of Jurassic and 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 protolithic composition and (or) age to unnamed units in the Taku Harbor and Juneau areas (Ford and Brew, 1977; Brew and Ford, 1977a), and correlative rocks are known on Admiralty Island to the southwest, as discussed in the previous section. Some 1,500 m (5,000 ft) of strata assigned to the Seymour Canal Formation of Late Jurassic and Early Cretaceous age, which consists of slate, graywacke, and conglomerate, also occurs on Admiralty Island. Rocks that correlate lithically with the Seymour Canal Formation occur at Point Fanshaw on the mainland side of the Stephens Passage about 65 km (40 mi) 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 would 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 occurs interlayered with the greenschist and greenstone 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–452A (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 iden-

tified 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 slate 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 Holdham Bay. I suggest that the marbles of Taku Harbor and Holkham Bay be considered Permian(?) in age.

The collections from Taku Harbor referred to occur in marble or limestone interlayered with phyllite, mica schist, chert, black graphitic slate, and 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. 3H014B (Upper Palezoic loc. 1122), lat 57 degrees 42 min 30 sec N., long 133 degrees 35 min 40 sec W., 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 [sic] textures strongly suggest this is a Paleozoic rock.

These limestone strata 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 greenschist and greenstone unit. No limestone has been recognized in the study area south of Windham Bay (pl. 1) or in the Port Houghton area to the south. To the north of the study area is the limestone on the Snettisham Peninsula, at Taku Harbor, and in the Juneau area (Ford and Brew, 1973; Brew and Ford, 1977a).

HIGH-GRADE ROCKS OF THE WESTERN METAMORPHIC BELT

The western metamorphic belt adjacent to the Coast plutonic complex sill consists of two main rock units, the biotite schist unit and the hornblende schist and amphibolite unit, and a minor unit, the marble and calc-silicate schist unit, which is also a map unit within the rest of the plutonic complex.

HORNBLENDE SCHIST AND AMPHIBOLITE

The hornblende schist and amphibolite unit is exposed continuously for about 65 km (40 mi) parallel to the Coast plutonic complex 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 of amphibolite metamorphic facies.

In more detail, and using the conventions noted earlier, the rock types in the hornblende schist and amphibolite 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.

The protoliths of these rocks were probably derived from a dominantly volcanic section that also included fine-grained detrital rocks, chert, perhaps graywacke, and minor carbonate rocks. These protolithic rock types are similar to those suggested for the greenschist and greenstone map unit and, indeed, on the Endicott Peninsula the hornblende schist and amphibolite map unit grade 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 hornblende schist and amphibolite map unit in its northeastern outcrop area is the host rock unit 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 is exposed continuously for 65 km (40 mi) immediately adjacent to the Coast plutonic complex 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 biotite schist unit in general consists of brown, fine- to medium-grained biotite and hornblende schist with significant amounts of micaceous quartzite. The rocks are of the amphibolite metamorphic facies, with gneiss more common closer to the sill. 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 in the biotite schist map unit 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 protoliths of the biotite schist unit were probably a fine- to medium-grained clastic section that contained significant amounts of chert, volcanic rocks, and, locally, thin carbonate rocks. These protolithic rock types are similar to those proposed for the phyllite and slate unit, 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 the host rocks for the Sumdum Glacier mineral belt (fig. 1), which is the highest mineral potential area in the study area. As noted previously, the unit there has been studied by MacKevett and Blake (1964).

MARBLE AND CALC-SILICATE SCHIST

One small area 2 by 0.2 km (1.5 by 0.1 mi) of marble and calc-silicate rocks occurs between the biotite schist map unit and the hornblende schist and amphibolite map unit east of Sumdum Island (pl. 1). These rocks, which are mapped as part of the marble and calc-silicate gneiss of Coast plutonic complex, consist of fine- to coarse-grained gray marble, calc-silicate rocks and schist, and biotite-quartz-feldspar schist.

HIGH-GRADE METAMORPHIC ROCKS OF THE REST OF THE COAST PLUTONIC COMPLEX

One widespread map unit, here called gneiss and schist of Coast plutonic complex, and a less widespread unit, here called marble and calc-silicate gneiss of Coast plutonic complex, 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 Coast plutonic complex sill.

GNEISS AND SCHIST OF THE REST OF THE COAST PLUTONIC COMPLEX

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

In general, this unit consists of fine- to coarse-grained heterogeneous granitic gneiss, migmatite, biotite gneiss, biotite schist, hornblende schist, calc-silicate rocks, quartzite, marble, and amphibolite of the amphibolite metamorphic facies. The unit was divided 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 rock types form the nongranitic phases of migmatite 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 in the gneiss and schist map unit 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 Chapter E, "Mineral Resources," 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 volcanic rocks. The quartzite and marble probably represent original chert and limestone within the complex section. Some granitic gneiss units may represent thoroughly deformed and metamorphosed original granitic bodies.

The correlation of any of the rocks within this part of the Coast plutonic complex is problematical, as discussed by MacKevett and Blake (1964). The rocks may correlate with some or all of the rocks of the western metamorphic belt discussed previously, and their protoliths would probably be of Permian(?) through Early Cretaceous(?) age. Alternatively, they may correlate with rocks exposed on the Canadian side of the International Boundary whose protoliths are considered by Souther (1959, 1971) to be of Carboniferous to Triassic age. Another alternative is that protoliths were early and middle Paleozoic in age; this is based on the observation that the closely associated marble and calc-silicate gneiss map unit, described later, 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 is 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 the gneiss and schist map unit.

MARBLE AND CALC-SILICATE GNEISS OF THE REST OF THE COAST PLUTONIC COMPLEX

The marble and calc-silicate gneiss map unit is irregularly distributed in the Coast plutonic complex, but most of the outcrop areas are concentrated along the northeast side of the Coast plutonic complex sill about opposite Holkham 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 rocks, 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 of the marble and calc-silicate gneiss map unit include medium- to coarse-grained gray (graphite)-calcite marble, (calc-silicate)-(actinolite)-calcite marble, diopside-calcite calc-silicate gneiss, wollastonite-calcite-silicate gneiss, garnet-diopside gneiss, and generally fine- to coarse-grained, locally iron-stained biotite-quartz-(feldspar) schist and 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 previously, the correlation of this unit and the enclosing gneiss and schist unit is problematical.

Although the rock types in this map unit 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 OR OLDER AGE

Ultramafic rocks of Cretaceous or older age occur as widely scattered pods and small bodies showing no direct field relation to each other. Different occurrences have been mapped as hornblende pyroxenite, clinopyroxenite, peridotite, and dunite and as undivided ultramafic rocks. 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-mi-) wide north-northwest-trending belt approximately through the center of the study area. Their distribution and origin have been discussed elsewhere (Grybeck and others, 1977).

The many small bodies shown on plate 1 are probably only a fraction of the actual number of bodies present; the ice, snow, precipitious 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 (31 mi) to the north. Very coarse to fine-grained sulfide-bearing ultramafic rocks occur along the shore west of the mouth of the Chuck River for a distance of approximately 3 km (2 mi). The body is layered in part and consists largely of clinopyroxenite with possibly 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 ft) in diameter, was mapped approximately 3 km (2 mi) 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 mi) north of the Dawes Glacier terminus within a unit of heterogeneous granitic gneiss and migmatite. Green-brown, coarse-grained hornblende pyroxenite and pyroxene-biotite-hornblendite occur as pods and boudins in dark-green medium-grained feldspar-hornblende gneiss with color index (C.I.) 70. At another locality 6 km (4 mi) east-northeast of the eastern lobe of Fords Terror a lozenge-shaped pod of gray-green medium-grained hornblende pyroxenite is alined parallel to the northwest-striking foliation in biotite gneiss, schist, calc-silicate rocks, quartzite, and marble.

The greatest concentration of ultramafic bodies in the study area is found between the eastern part of Tracy Arm and the large northeast-trending valley parallel to and just south of the Whiting River. The bodies occur within a variety of types 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 mi) above the rapids. Although poorly known at present, this body apparently consists mainly of hornblendite, hornblende gabbro, and peridotite surrounded by hornblende gneiss.

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 OR TERTIARY AND OF CRETACEOUS(?) AGE

One granitic rock unit of Cretaceous(?) age and two of Cretaceous or Tertiary age are mapped in the study area and vicinity. The two of the Cretaceous or Tertiary age are the (1) biotite granodiorite and hornblende-biotite granodiorite and (2) Coast plutonic complex foliated tonalite sill. The unit of Cretaceous(?) age is the porphyritic garnet-biotite-hornblende quartz diorite. On plate 1, the first and third of these have been included in the foliated biotite-hornblende tonalite unit and the third is the porphyritic garnet-biotite-hornblende quartz diorite unit. All 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. 20–40, biotite granodiorite and 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 rocks, 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 relation with the mid-Tertiary granitic bodies is known. There are no metallic mineral deposits clearly associated with this unit.

The informally named Coast plutonic complex tonalite sill is a well-foliated body from 3 to 8 km (2 to 5 mi) in width that extends from well beyond the study area to the south (Brew and others, 1976; Brew and Ford, 1981) to beyond the northwestern boundary of the study area, a total of over 80 km (50 mi). The unit consists of foliated, generally homogeneous medium- to coarse-grained C.I. 20–25 biotite-hornblende quartz diorite and tonalite, hornblende-biotite quartz diorite and tonalite, and 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 triangle (Streckeisen, 1973) (fig. 5).

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.

The Coast plutonic complex tonalite sill also includes two bodies of porphyritic biotite granite, one lying 0.8 km (0.5 mile) east of the entrance to Fords Terror and the other 10 km (6 mi) to the northwest. The rock is a homogeneous, foliated, fine- to medium-grained C.I.

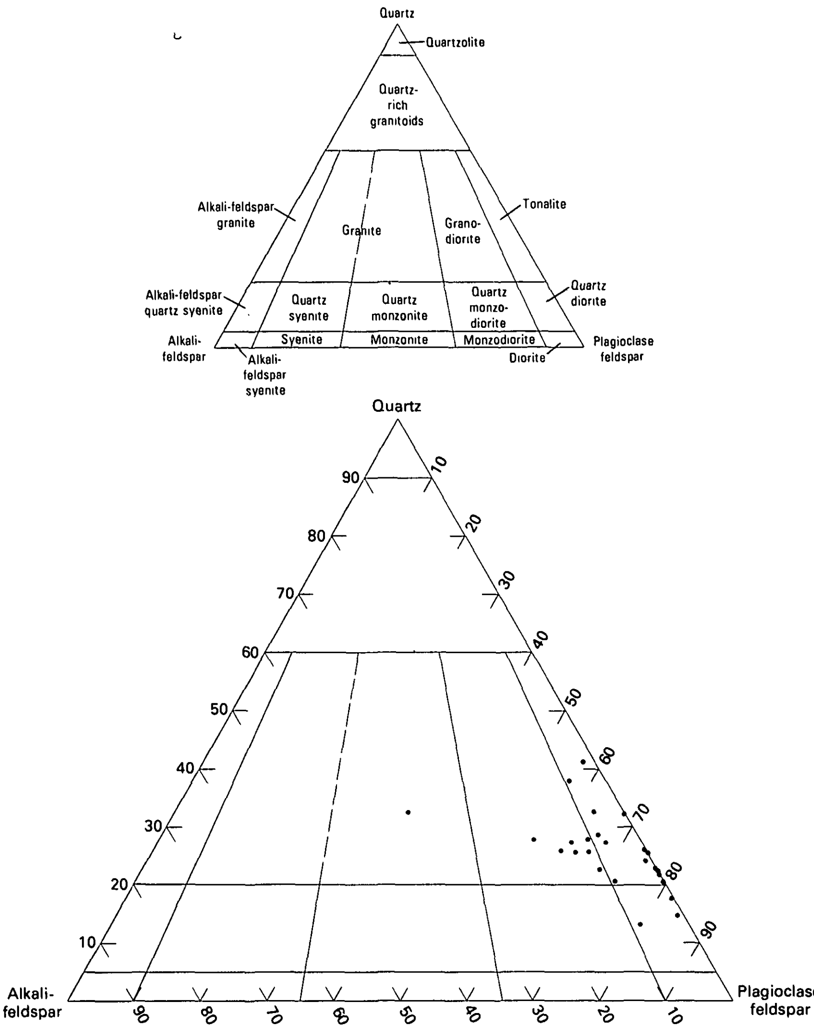

FIGURE 5.—IUGS triangular diagram showing modal compositions of rocks from the Coast plutonic complex sill.

5–10, biotite granite with conspicuous feldspar phenocrysts. Biotite-hornblende-feldspar gneiss, calc-silicate rock, and biotite-quartz-feldspar gneiss are mixed with the biotite granite near its contacts.

The Cretaceous or Tertiary 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 biotite and a partial resetting in the hornblende 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. Rocks of that unit generally have less quartz than the Coast plutonic complex tonalite sill, but they are mentioned here because the quartz diorite unit occupies the same relative position in Souther's sequence of intrusions as the sill 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, 1926a, b) prospects and other deposits in the Sumdum Glacier mineral belt are spatially associated with the southwestern contact of this body. MacKevett and Blake (1964) concluded that the Sumdum copper-zinc deposit probably postdates at least the main deformation and intrusion in this part of the Coast Range, but they left open the possibility that the ore constituents were derived from late-stage fluids associated with the plutonic complex. We conclude that the deposits have been deformed and metamorphosed.

The porphyritic garnet-biotite-hornblende quartz diorite unit is restricted to the Endicott Peninsula, occurring both as stocks and as sill-like masses of variable size. The unit is best exposed 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, and 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, which have conspicuous layering. Contacts everywhere are sharp.

The Cretaceous(?) age of this unit is based on lithic correlation with isotropically dated rocks far to the southeast near Ketchikan. These bodies may locally deform, and thus postdate the foliation in the enclosing map units.

GNEISS DOME ROCKS OF CRETACEOUS OR TERTIARY AGE

One well-developed and two less well developed unusual gneiss domes a few square kilometers (about one square mile) in area are exposed in the study area. A probable extension of the well-developed dome has also been studied outside of the study area. The well-developed dome is informally called the Endicott Arm gneiss dome. The other two features are called the Tracy Arm and Dawes Glacier domes. All have steep sides that flatten gradually upward toward 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 rocks are granodiorite. The core rocks are in general in sharp contact with the surrounding schist and darker gneiss, 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, which are of inferred Late Cretaceous or early Tertiary 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 or Tertiary age described previously. No relation has been established between the core rocks and the granitic rocks of Tertiary age described later.

The Dawes Glacier gneiss dome underlies that glacier near its terminus and is separated from the Endicott Arm gneiss dome by the Coast plutonic complex sill. 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 constitute up to 40 percent of the rock, and minor screens of diopside-wollastonite-marble 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 mi) from its head, was mapped in the field as foliated biotite-hornblende quartz diorite and biotite granodiorite. This dome is long and narrow and its northern contact is 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, and 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, mapped mainly as hornblende-biotite granodiorite (pl. 1). This belt widens to the west in the northern part of the study area. There are also scattered nearby granitic bodies that are inferred to be of Tertiary age. Both types of occurrences have associated migmatites. 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. 6) of the IUGS plutonic rock triangular diagram. 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 and biotite granodiorite.

Migmatites have been mapped extensively along the southwestern side of the granitic area along the International Boundary (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 rocks. 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. Most of the scattered granitic bodies are surrounded by 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 yield concordant ages in the range from 49 to 54

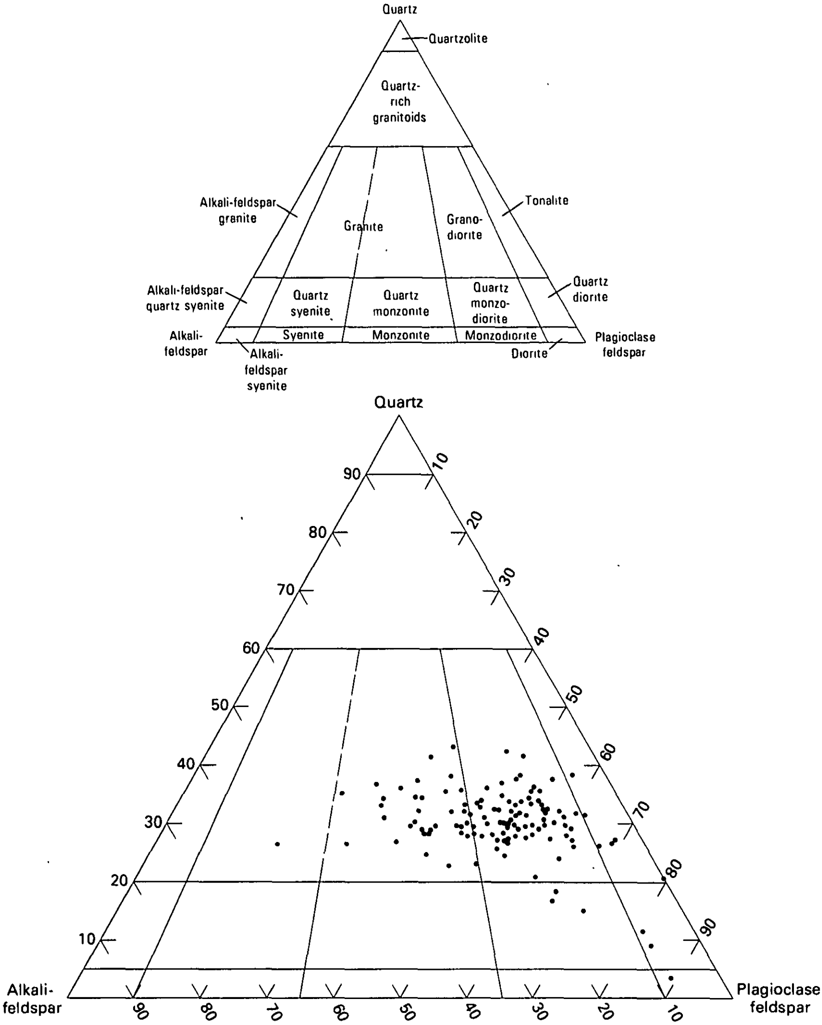

FIGURE 6.—IUGS triangular diagram showing modal compositions of Tertiary granitic rocks and associated migmatites.

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) from lithically correlative rocks to the northeast in Canada.

Immediately across the boundary near Mount Odgen (pl. 1) are known molybdenite deposits associated with Souther's "younger quartz monzonite," and there are copper-molybdenum deposits nearby elsewhere in the unit (Souther, 1971). In the Juneau Icefield area, Brew and Ford (1969) described a small molybdenum-silver occurrence associated with granitic rocks that 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 closedly related, (2) both are probably correlative with the Tertiary granitic rocks of the Tracy Arm–Fords Terror area, and (3) this group of intrusions 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 are more or less 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 occur along the floors and sides of most valleys, and glaciers and permanent snowfields cover perhaps 25–30 percent of the study area.

The surficial deposits include recent alluvium along the lower gradient parts of streams, colluvium on almost all hillslopes, 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 mi) to Stephens Passage; inland to the northeast is first a zone several kilometers (several miles) wide with small cirque, carapace, and valley glaciers and then a similar zone, but with tidewater glaciers entering the heads of the large fiords. Large icefields along the International Boundary form the farthest inland zone; here, only scattered nunataks protrude above the ice plateaus, which feed the large tidewater glaciers.

STRUCTURE

The general structure of this part of the Coast plutonic complex appears to contrast strongly with that of the western metamorphic belt. This is because the large amount of granitic rocks, the isolation of the screens and pendants of metamorphic rocks, and the much greater proportion of gneiss 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 discussions in this report show, it may not indicate a real difference in deformational history.

The Coast plutonic complex sill, whose emplacement is considered likely to have been structurally controlled, separates the western metamorphic belt and the rest of the plutonic complex. It is inferred (Brew and others, 1976; Brew and Ford, 1978, 1981) to be more than 225 km (140 mi) long altogether, and except at the Mount Juneau pluton (Ford and Brew, 1973), it closely coincides with the boundary between the coarse-grained gneiss and granitic rocks of the plutonic complex and the schist and quartzite of the higher grade part of the western metamorphic belt. The foliation in the sill parallels that in the adjacent rocks. The sill probably was intruded along a discontinuity of some kind and is syntectonic or late tectonic.

This structural discontinuity is close to and consistently parallel to the "Coast Range megalineament," a structure that extends the length of southeastern Alaska and that is locally a fault (Brew and Ford, 1977b, 1978). 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 those topographic lows and across the mountains and ridges south of Endicott Arm (pl. 1). The width of the zone is about 13 km (8 mi) maximum and its length within the study area is about 68 km (42 mi). The megalineament, like the Coast plutonic complex 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-mi) 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 chapters B and C, 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 plutonic 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 to 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, and distinctive limestone and dark shaly phyllite units generally show several hundred meters (about 1,000 ft) 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 conspicuous lineament zones about 3 km (1.9 mi) 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.

Few data are available on fold styles and deformation in the gneiss of the Coast plutonic 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 through east and southeast.

As noted earlier, the Coast plutonic complex sill is well foliated. Foliation is present locally in the migmatite units associated with Tertiary granitic bodies in the plutonic 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 deformation episodes. In a few places, such as Bushy Islands 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 have been transposed and have 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 parallel to the axial plains of the first folds, being isoclinal about moderately to steeply southeast-plunging axes. Unfortunately, there are no key layers to clearly verify this suggestion. Loney (1965) has shown the complexity of deformation in an area about 64 km (40 mi) to the southwest across Stephens Passage.

The age of the folding in the higher grade part of the plutonic 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 metamorphic belt are here considered to apply to both areas. On the basis of regional paleontologic and lithologic evidence, the protolithic age of the youngest metasedimentary and metavolcanic rocks in the western metamorphic belt is considered to be Late Triassic. It is possible that protoliths of Upper Jurassic and Lower Cretaceous age are also present, but there is no definitive evidence. The upper limit is controlled by the age of the Coast plutonic complex sill: its foliation appears to be related to the latest fold episode, and it was probably emplaced during or shortly after that deformation. The sill lithically and structurally resembles granitic bodies of middle Cretaceous age known elsewhere in southeastern Alaska (Loney and others, 1967). Efforts to date this body by the K-Ar method on coexisting biotite and hornblende pairs have yielded either ages equal to those of the crosscutting nonfoliated mid-Tertiary granodiorite bodies along the International Boundary, which probably indicate complete resetting of the K-Ar system in both minerals at the time, or discordant ages, with biotite giving the mid-Tertiary age and hornblende giving an early Tertiary age, which indicates partial resetting of the system in the hornblende. Preliminary results of lead-uranium system studies on zircon from probably correlative rocks far to the southeast near Ketchikan suggest a Paleocene or Eocene age (J. Arth, oral commun., 1981). The minimum age for the sill and for the deformation is considered mid-Tertiary and it is possible that it is at least as old as Late Cretaceous. These lines of reasoning all are compatible with a middle and (or) early Tertiary 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 Coast plutonic complex 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 previously for the western metamorphic belt, superimposing lineations parallel to its axis on the earlier structural elements. The age of emplacement is inferred to be younger than the Coast plutonic complex sill and older than mid-Tertiary granodiorite bodies 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 (60 mi) in a north-northwesterly direction through the gneiss of the batholithic complex (pl. 1) (Grybeck and others, 1977). The belt is a maximum of 19 km (12 mi) wide and the individual bodies range in size from a few meters to 4 km (10 ft to 2.5 mi) 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 ultramafic rocks.

Of the structures described in this section, the folds in the western metamorphic belt and the possible Coast plutonic complex sill 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 the mineralization is older than most of the recognized intrusive history. The Coast plutonic complex 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 physiographic 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 with the study area coincides approximately with the Coast Range megalineament, which forms a prominent northwest-trending trough in the Port Snettisham and Holkham Bay areas and a strikingly parallel-grained terrane where it leaves Endicott Arm to the south.

The geomorphology and Quarternary 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 ft) 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 1,200–1,800 m (4,000–6,000 ft) (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 without leaving much of a record of its own. Marine deposits like those of late Pleistocene and early Holocene age described by R. D. Miller (1972, 1973) near Juneau have not been recognized in the study area. If present, they would postdate any major ice sheet coverage.

The Boundary Ranges subprovince is typified by deep fiords, such as Tracy Arm, Fords Terror, and Endicott Arm; by rugged mountain peaks as high as 2,470 m (8,095 ft) with their abundant hanging, carapace, and cirque glaciers, steep peaks and arêtes; and by broad dentritic icefields that feed the tidewater glaciers at 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 exposeure as much as 16 km (10 mi) 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 the two major valleys and isolates an unusual 20 by 30 km (12 by 18 mi) block that has remarkably concordant summits at about 1,400 m (4,500 ft).

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 (R. D. 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 Islands in Endicott Arm. Some of the abandoned higher cirques contain small terminal moraines, and most of the active glaciers have associated terminal or lateral moraines.

It appears that 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 mi).

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.

Present 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, except in the major low-level rivers and probably 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 material. The influence of these effects is discussed in chapter D.

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Interpretation of the Aeromagnetic Data

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

GEOLOGICAL SURVEY BULLETIN 1525–B

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

INTERPRETATION OF THE AEROMAGNETIC DATA

By ROBERT C. JACHENS, U.S. GEOLOGICAL SURVEY

INTRODUCTION

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 km^2 (1,930 mi^2) 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 (1 mi). The aircraft maintained a nominal barometric altitude of 1,830 m (6,000 ft), but the flight level was increased by 15 percent or more in some areas in order to clear the higher mountains.

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 relative to a datum of 57516 γ and after removing 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.

RESULTS

Measurements of the magnetic properties of 14 rocks from the study area (table 2) tend to support the concept that the igneous intrusive rocks generally are more magnetic than the metamorphic rocks. The only sample of metamorphic rock that shows a moderate magnetic susceptibility (1.67×10^{-3} emu/cm^3) was obtained from a rock unit that has a weak magnetic high associated with it. None of the samples tested showed any appreciable remanent magnetization.

For the purposes of discussion, the aeromagnetic map has been divided into four numbered regions on the basis both of magnetic character and of correlation with the mapped geology (fig. 7). Also shown

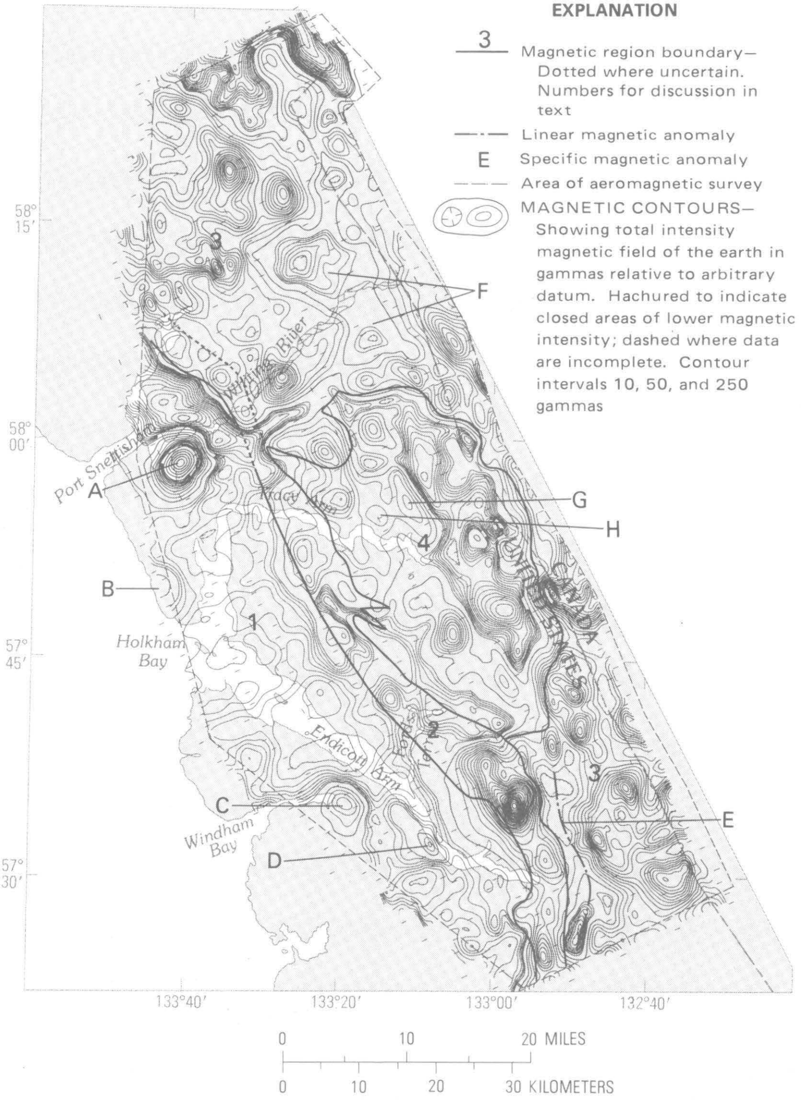

FIGURE 7.—Aeromagnetic map of study area and vicinity showing regions and specific anomalies. Aeromagnetic survey by GeoMetrics, Inc. 1973.

in figure 7 are specific magnetic anomalies, designated by letters A–H, which are not correlated with topography and which are discussed later.

The study area is characterized by high topographic relief. In much of the region, peaks and ridges rise more than 1,500 m (4,900 ft) 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 and valleys tend to have associated magnetic lows. Amplitudes of topographically caused magnetic anomalies can be large, and they reach values of 600γ or more in this area. These strong anomalies tend to mask the subtler anomalies that might arise from minor differences in magnetic properties of the underlying rocks. As a result, interpretation of the aeromagnetic map in terms of geologic structure is restricted to those features that give rise to anomalies larger than the anomalies caused by topographic features. These anomalies are not correlated with the topography or are of substantially different wavelength than the topographic features.

In general, most of the prominent magnetic anomalies shown on plate 1 are cased 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 rest of the Coast plutonic complex. Exceptions to this general statement are some bodies of gneiss and amphibolite of the complex, which appear to be, on average, slightly magnetic.

Region 1 corresponds, with minor exceptions, to the western metamorphic belt. Within the study area, the northeastern boundary of this region corresponds to the mapped southwestern edge of the Coast plutonic complex sill, 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 parts of the study area, is greater than 1,200 m (3,900 ft) in some places. The magnetic field in region 1 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 overlie ultramafic bodies exposed at the surface. Anomaly A, about 2,000 in amplitude and the largest anomaly on the map, lies over the magnetite-rich ultramafic body at Port Snettisham; anomaly B, over ultramafic rocks exposed on the Midway Island; and anomaly C, over an ultramafic body at Windham Bay, 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's upper face is roughly 2 km by 3 km (1.2 mi×1.9 mi), whereas that of the

Windham Bay body is slightly larger, roughly 2 km by 4 km (1.2 mi×2.5 mi). Both bodies extend to depths of several kilometers (a few miles). The Port Snettisham body is almost vertical, but the Windham Bay dips to the south. These calculations also indicate that the Windham Bay body 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 difference, in turn, suggests a significant difference in mineralogy between the two bodies, at least in terms of their magnetic mineral content. Thus, the Windham Bay body must contain a considerably smaller proportion 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 geologic units. This anomaly probably is caused by a narrow, shallow, steeply dipping dike approximately 10 km long. Because of the spatial association between the southwestern contact of the Coast plutonic complex sill and some of the potentially economic mineral occurrences mentioned in this report, it should be noted that a 600-m (1,960-ft) wide vertical dike reaching within about 700 m (2,300 ft) 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 relation between the source of this anomaly and the nearby sill must be considered highly speculative.

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

Region 2 is underlain by the Coast plutonic complex sill. The boundaries of this unit have been extended northwest and southwest of the study area on the basis of their magnetic expression. This rock unit is characterized by a discontinuous magnetic high along its southwestern contact that gives rise to the steep magnetic gradients encountered in crossing from the western metamorphic belt to the rest of the Coast plutonic complex. This gradient coincides with the Sumdum Glacier mineral belt. The discontinuous nature of the magnetic high results both from topographic influences and from highly variable magnetic properties associated with the rock in this unit. The 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 south of Fords Terror to anomalies of 200–300 immediately north of Fords Terror can be accounted for only partially by topographic effects. Magnetization variations of an order of 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, 8 km (5 mi) or more in some regions.

Region 3 is underlain by granitic rocks, migmatites, and metamorphic rocks of the Coast plutonic complex. The region is characterized over most of its extent by a magnetic pattern of moderate- to high-amplitude short-wavelength anomalies that correlate very well with the topography. This topographic correlation is well illustrated in the southeastern part of region 3 by the long linear magnetic low that follows the South Sawyer Glacier and the line of magnetic highs adjacent to and west of this low. Along this line, the peaks of the magnetic anomalies fall very close to the topographic peaks. Other examples, such as the pronounced magnetic low that follows the Whiting River valley, are also present in the northern part of region 3. 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 Coast plutonic complex 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 rocks 1–2 km (0.6–1.2 mi) thick overlying the magnetic granitic rocks.

Region 4, bounded on the west by the Coast plutonic complex sill and on the south, east, and north by the granitic rocks of Tertiary age, is underlain by igneous and metamorphic rocks of the main part of the Coast plutonic 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 4 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, which indicates that these rocks are the source of the anomalies. However, not all bodies of amphibolite and gneiss in this region have associated magnetic anomalies.

The strongest 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 4 are interpreted to be isolated bodies of limited dimension rather than the exposed parts of a large pluton that 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 3 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 4 reflect a contact between magnetic and nonmagnetic rock units that extends to considerable depth.

The ultramafic bodies of the main part of the Coast plutonic complex have very little magnetic expression, a feature 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 body of pyroxenite; whereas, the lozenge-shaped peridotite body exposed 3 km (1.9 mi) west of anomaly H caused, at most, a slight deflection of the magnetic contours. None of the other ultramafic bodies in this part of the Coast plutonic complex has 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 (2,620 ft) of vertical exposure, and reaches within about 450 m (1,480 ft) 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 western metamorphic belt.

Interpretation of the Available Gravity Data

By DAVID F. BARNES, U.S. GEOLOGICAL SURVEY

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

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

INTERPRETATION OF THE AVAILABLE GRAVITY DATA

By David F. Barnes, U.S. Geological Survey

INTRODUCTION

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.

RESULTS

No gravity data were collected during this investigation of the Tracy Arm–Fords Terror wilderness study area, but a small amount of data had been obtained during an earlier gravity reconnaissance of southeastern Alaska. That survey was designed primarily to obtain data for a 1:2,500,000-scale 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 MV *Waters* and RV *Don J. Miller II* served as support vessels. These traverses provided data at intervals of about 3 km (2 mi) along the shorelines of all navigable waters and along much of the Alaskan length of the Whiting River. Five additional 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 (166 lb/ft^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, d, e; Barnes and others, 1972a, b).

Figure 8 shows a more recent compilation of the data, which has been 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 (International Association of Geodesy, 1971). Second, the gravity datum has been coverted 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 were provided for the two base stations used in the survey, which are also shown in figure 8. 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 U.S.G.S. 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 U.S.G.S. marker is now 981,717.12 mgal.

The most prominent feature of the gravity field depicted in figure 8 is the belt of the subparallel contours that approximately coincides with the Coast plutonic complex 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 gravity near the continental margin to anomalies as low as -120 mgal near the International Boundary. The steeper part of the gradient is caused by (1) the probable gradual thickening of the crust from perhaps 15 km (9.3 mi) beneath of Gulf of Alaska to about 45 km (28 mi) 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, and (3) a suggested decrease in rock densities between the western metamorphic belt and the rest of the Coast plutonic complex. This contrast in rock density is probably most pronounced and extends to greatest depth along the trend of the Coast plutonic complex sill. Because the gradient is a combined effect of at least

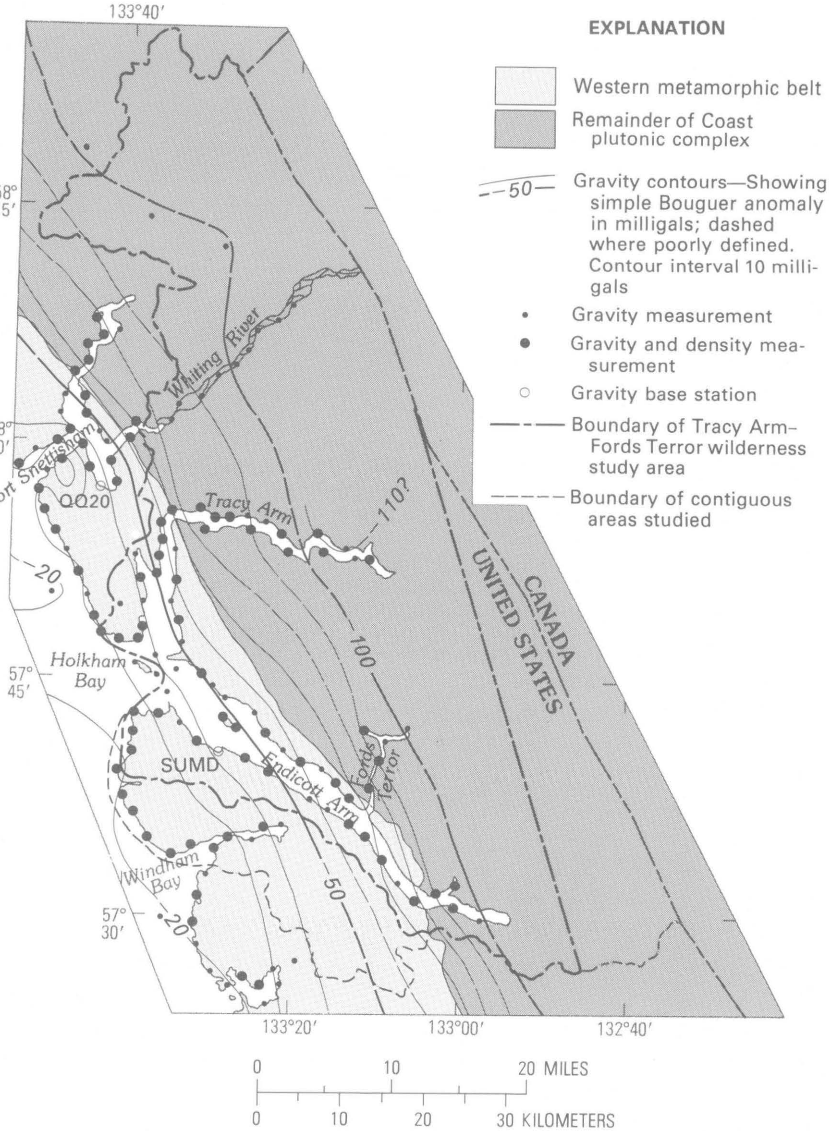

FIGURE 8.—Bouguer gravity map of study area.

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 15–25 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 are shown in figure 8, and the resulting data are summarized in table 3. An obvious conclusion from 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. Nevertheless, the rock sampling is sufficeint to show that the highest average densities were obtained in both the plutons and metamorphic rocks of the western metamorphic belt. Furthermore, the sampling did not include any typical ultramafic rocks, so the mean for the western metamorphic belt plutons should be higher. A good mean density for pyroxenite and dunite sampled in other areas would be about 3,250 kg/m^3 (202 lb/ft^3) (Daly and others, 1966). Table 3 also shows that the least dense rocks in the study area are the Tertiary granodioritic rocks of the Coast plutonic complex.

With this information one can make a very approximate estimate of the probable thickness of the Coast plutonic complex. The anomaly represented by the belt of parallel contours has a magnitude of about 75 mgal; terrain corrections would probably reduce the anomaly to about 60 mgal. 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 Coast plutonic complex sill suggests a shallower source of density contrast. This anomaly and a maximum density contrast of about 200 kg/m^3 (12.4 lb/ft^3) between the plutonic 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 (1.5 mi). 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 plutonic complex. The minimum thickness of this pendant is probably close to that of the complex, because the density contrast between the eastern metamorphic rocks and the granodiorite 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 (31 lb/ft^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 (0.6 mi) 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 contour flexure from the map boundary that encircles a station on Midway Island, where more mafic rocks were observed. It 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 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.

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Geochemistry of the Tracy Arm–Fords Terror Wilderness Study Area and Vicinity, Alaska

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

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

GEOCHEMISTRY OF THE TRACY ARM–FORDS TERROR WILDERNESS STUDY AREA AND VICINITY, ALASKA

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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 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 before geologic mapping was begun. Wherever possible, clay-size or silt-size material from active stream channels above the highest high-tide level was collected. Clay- or silt-size material was difficult to obtain from streams with steep gradients or adjacent to glaciers, and some samples consisted mostly of sand size and larger material. Each sample was dried and screened, and the 80-mesh fraction was analyzed according to procedures described in the introduction to this report.

The material sampled at different sites reflects different 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 part of the metallic content. Samples from streams above timberline or adjacent to glaciers, even when composed of clay- or silt-size material, are probably largely mechanically broken rock material, and chemical solution and deposition is probably minor. Some of the major rivers flowing below timberline, such as the Whiting River, are also depositing fine sediment by the settling of glacier 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.

Bedrock samples were 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 (per 0.4 mi^2). Each distinct rock type present at each station was sampled and particular care was taken to sample all rocks with visible alteration, iron 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. laboratories for analysis. Accompanying each sample was coded basic data, such as sample location, sample type (rock or stream sediment), and field number. The geochemical analytical procedures used for all samples are discussed in the introduction to this report. The analytical results and the coded data were stored on computer disks at the Geological Survey DEC–10 computer installation in Denver using the RASS II program.

Over 5,000 samples collected by Geological Survey parties were processed and analyzed: 792 were stream-sediment samples, and 4,228 were 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 that 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, 1977).

The interpretation and synthesis of the geochemical information and the interpretation of geochemical distribution patterns depend on statistical analyses 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 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. 10). Because geochemical distributions are in general closely approximated by the log-normal distribution, a log-transformation was performed on all analytical values before plotting the histograms. The log-transformation allows the portion of the histogram that 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 rock types and because of site-location variability and other factors, a single threshold value was not used for each element. Instead, two threshold values were used representing weakly and distinctly anomalous levels. Weakly anomalous values are those in the upper 5 percent of the values or that are somewhat higher than normal geochemical abundance values; they may represent only variability due to sampling or analytical techniques or a high 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 are 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 that meet or exceed these levels in one or more elements. The locations of these samples are plotted and identified by sample number on plate 2.

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 (1) by comparison with the normal geochemical abundance of the elements in various rock types (Levinson, 1974) and (2) by inspecting the histograms for natural breaks (bimodal distributions) and for "tailing out" to the highest values. This process was intended to avoid either selecting a statistically normal high level from essentially nonmineralized samples or selecting an extremely high level from a heavily mineralized area. Only one anomalous level was identified for some elements (table 4) because the process did not produce a distinctly anomalous level. Elements not shown in table 4 or 5 were not included in the geochemical interpretation because they were not pertinent or because there were no results above the instrumental detection limits.

The definition of anomalous threshold levels for rock geochemical samples is more complicated 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 given value for an element may be anomalously high in one rock unit but only average in another. Because of the variation in the background level from unit to unit, we treated and interpreted the elemental abundance pattern separately for each of the 13 rock units shown on plate 1. The data were manipulated as described for the stream-sediment samples, except that for the bedrock samples the 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 for two reasons. First, many of the map units had too few samples to be statistically meaningful; and second, 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, on the basis of statistical comparison of the 13 map units for each analyzed element and visual comparison of the histograms for each element, we combined the 13 units 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.

A single anomalous level was then defined for each element in each of the bedrock geochemical units; these threshold levels (table 7) were determined by the process described for stream-sediment samples. As with the stream sediments, not all elements are included. Table 8 lists the analytical data for 262 bedrock geochemical samples that contain amounts of one or more elements and gives their descriptions. The locations of the samples are plotted and identified by sample number on plate 2. After these manipulations, distribution patterns of important elements were analyzed to determine their economic significance, if any; these interpretations are given below.

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 nor silver in amounts less than 0.5 ppm. Levinson (1974) stated the average crustal abundance of silver is 0.07 ppm and 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 study area (fig. 9) shows a marked concentration in the western metamorphic belt. Anomalous gold and silver occur in both stream sediments and rocks throughout this belt (with the exception being at its southern end where sample locality density is less (pl. 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 main part of the Coast plutonic complex contains widely scattered 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 has 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 belt, than is now recognized.

COPPER

Although copper has not been produced from the study 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. 10). The ultramafic rocks contain by far the most copper, from less than 5 ppm to 2,000 ppm. The world average copper content in ultramafic rocks 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

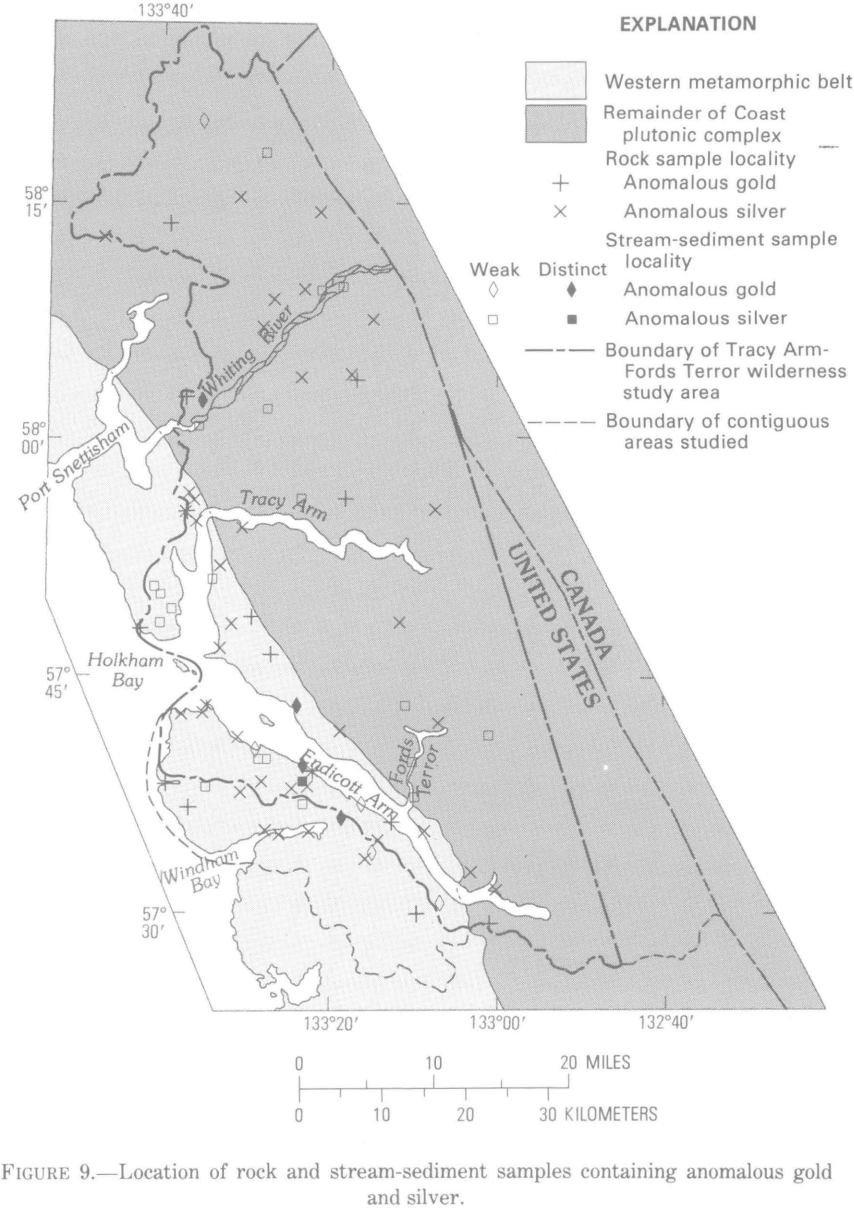


FIGURE 9.—Location of rock and stream-sediment samples containing anomalous gold and silver.

rocks. Some of the ultramafic bodies, such as that at Windham Bay, which has distinctly anomalous copper in both rocks and stream sediments associated with it (fig. 11), may represent a copper resource. Nevertheless, their small size would limit their significance.

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

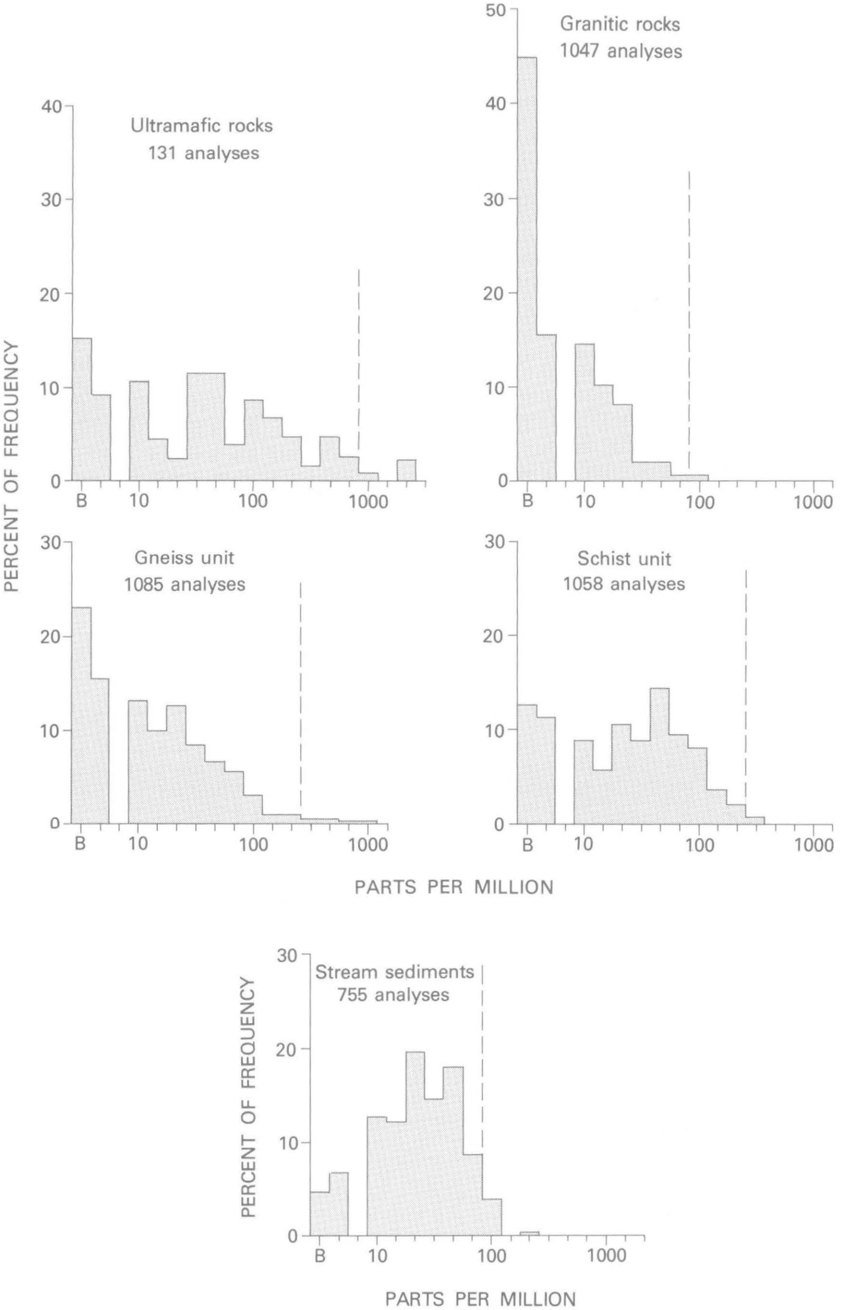


FIGURE 10.—Histograms of distribution of copper in rock and stream- sediment samples. Values to the right of the vertical dashed line are anomalous as defined in this report (tables 4, 7). Analyses by semi-quantitative spectrographic method are reported in a six-step series utilizing the values . . .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

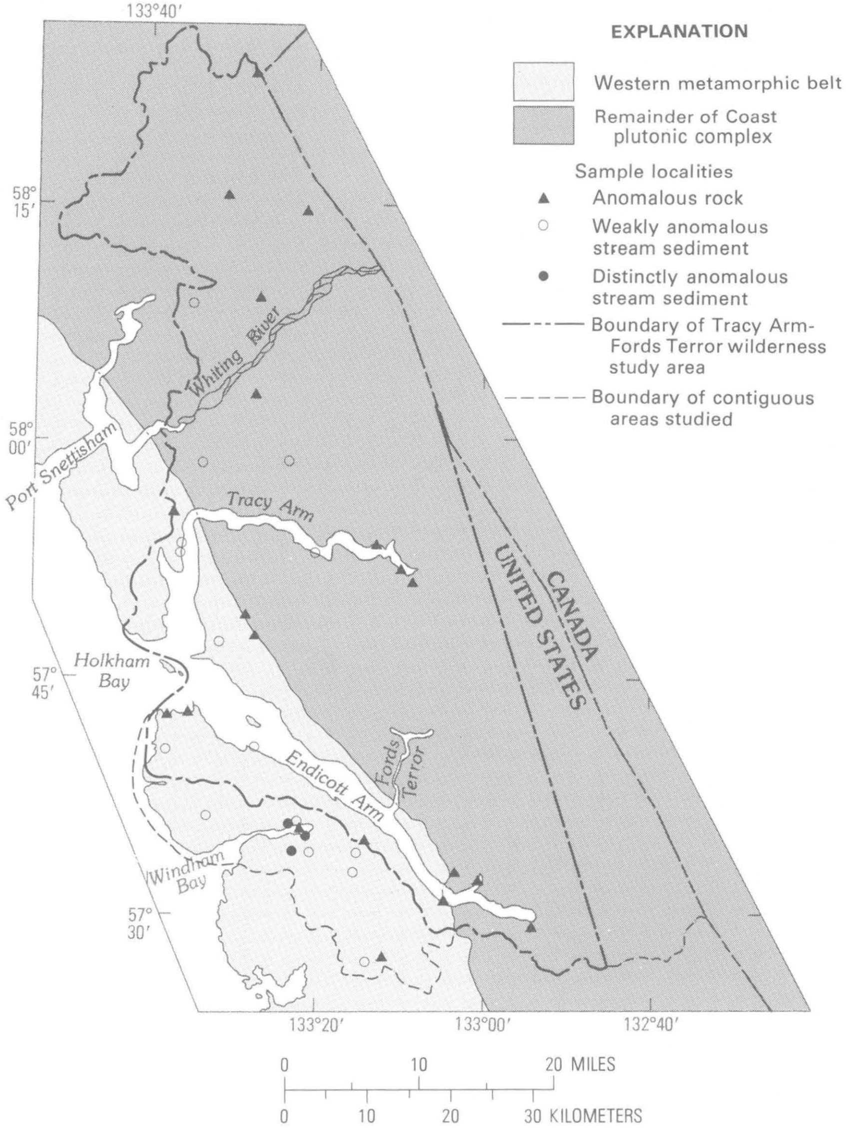


FIGURE 11.—Location of rock and stream-sediment samples containing anomalous copper.

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 2–120 ppm. In the study area, the schist bedrock geochemical unit contains about 50 ppm, the highest average copper content of any of the non-ultramafic rocks. This value is not unlikely because andesite and shale, the probable precursors of the dominant greenschist and phyllite in the schist unit, have 35 ppm and 45 ppm copper, 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 largest number of the anomalous rocks and stream sediments in the area (fig. 11). In contrast, the rocks in the main part of the Coast plutonic complex contain only a few anomalous samples, and most of them are in metamorphic rocks.

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 sediment were the product of mechanical breakdown of these rocks and of direct deposition of that material in the stream, then the copper distribution in the stream sediment 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 it cannot explain the relative absence of values below 10 ppm. It is likely that copper is being selectively absorbed on clay minerals, organic material, and iron hydroxides in the stream sediment.

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 molydenum in most crustal rocks. Levinson (1974) gave the average crustal abundance of molybdenum as 1.5 ppm with a maximum average of 3 ppm in granite for igneous rocks and 3 ppm in shale 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. 12) of molybdenum in the rocks and stream sediments are generally similar, although the gneiss unit and schist unit have a somewhat higher molybdenum content than the granitic rocks. Most of the anomalous samples (fig. 13) 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

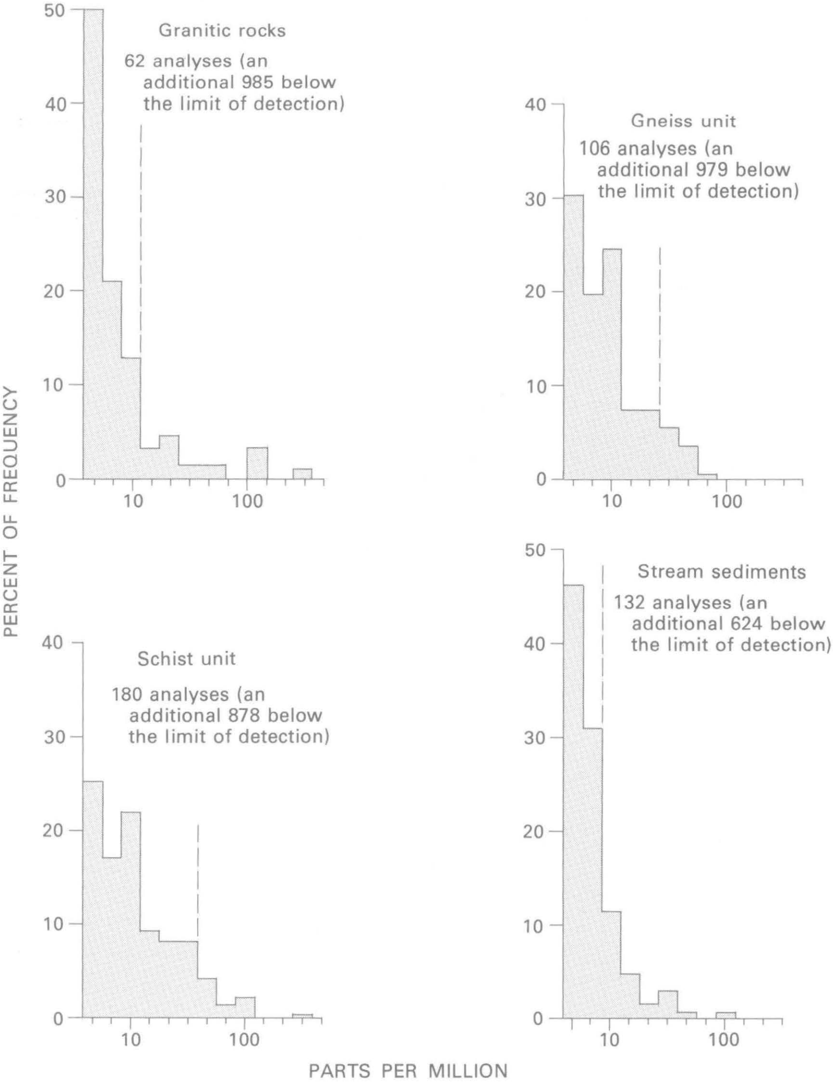


FIGURE 12.—Histograms of the distribution of molybdenum in rock and stream-sediment samples. Values to the right of the vertical dashed line are anomalous as defined in this report (tables 4, 7). Analyses by semiquantitative spectrographic method are reported in a six-step series utilizing the values . . . 1, 1.5, 2, 3, 5, 7, 10 . . . as the midpoints of the steps. Only values above the limit of detectability are used.

Windham Bay on the Endicott Peninsula is particularly attractive because it has a number of anomalous stream-sediment and rock samples associated with a body of hypabyssal porphyritic garnet-biotite-hornblende diorite, and this area is known only through reconnaissance study.

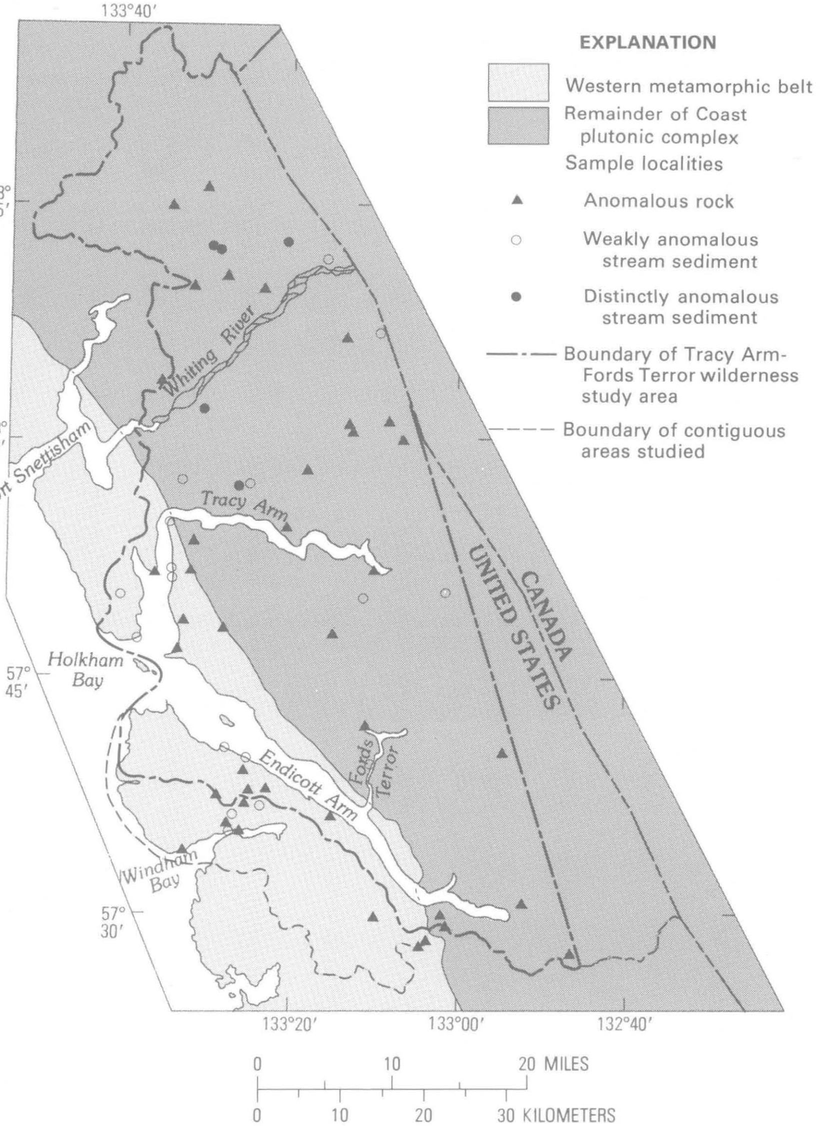


FIGURE 13.—Location of rock and stream-sediment samples containing anomalous molybdenum.

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 are markedly anomalous.

Levinson (1974) indicated that 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. 14) rarely contain as much as the 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 (fig. 15), shows not only the highest lead content but also the largest number of anomalous rock and stream-sediment samples. The gneissic rocks of the batholithic complex have scattered anomalous occurrences in rock and stream-sediment samples, particularly between the Whiting River and Tracy Arm.

The lead content of the ultramafic rocks is exceedingly high in comparison to its average crustal abundance. Levinson (1974) stated that the average lead content of ultramafic rocks is 0.1 ppm, and Goles (1967) indicated even less. That figure 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. The 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.

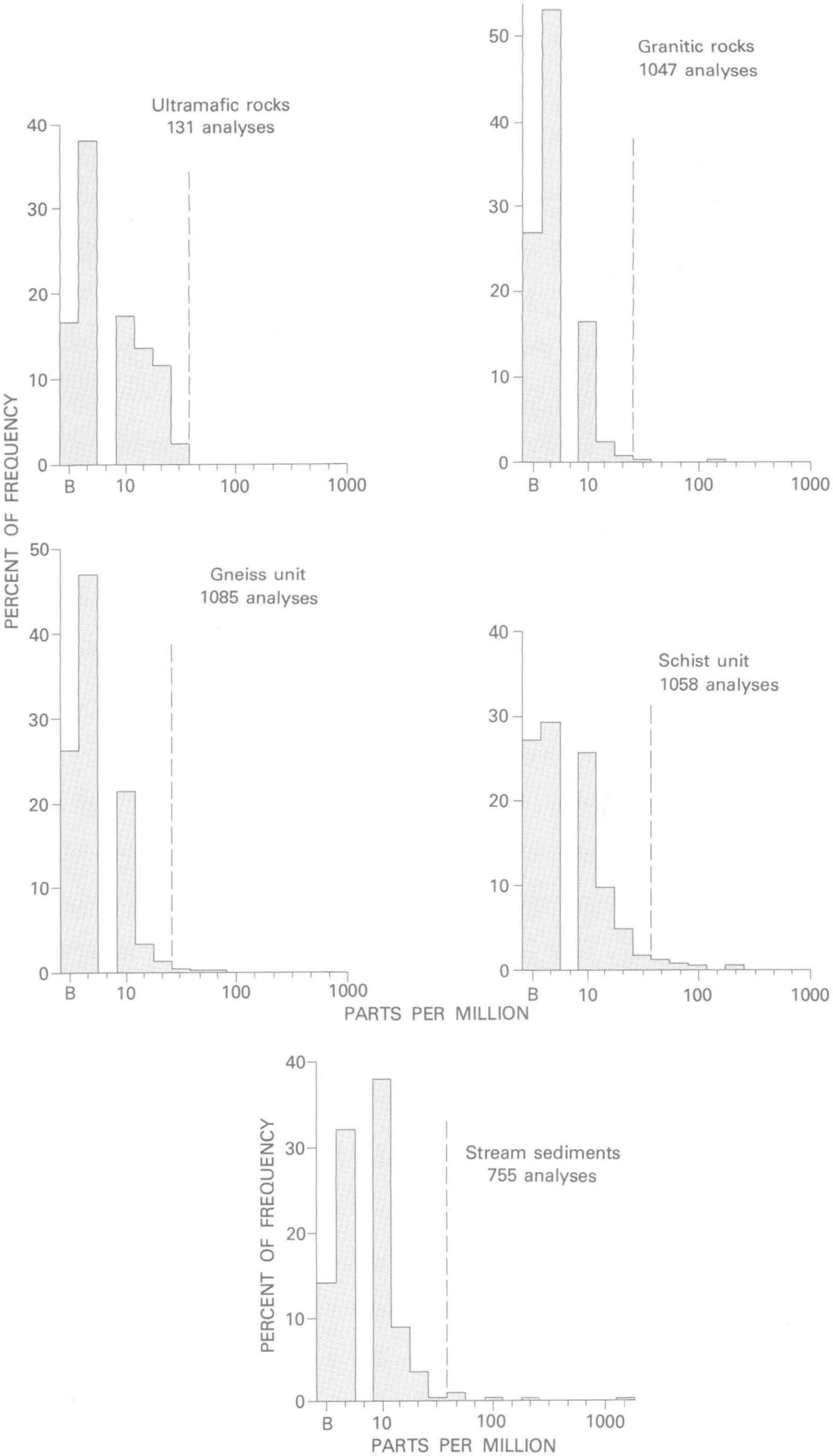
The geochemical data suggest the absence of significant lead deposits in the study area. The distribution of samples with anomalous values does, however, support the general concept of base-metal mineralization in the western metamorphic belt.

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) indicated most rocks contain 25–100 ppm zinc; Wedow and others (1973) gave similar values and emphasized that certain rocks, for instance carbonaceous shale, may contain several thousand ppm or more zinc. A few of the rock samples (fig. 16) in the study area contain 1,000 ppm zinc, but most histograms have a

FIGURE 14 (facing page).—Histograms 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, 7). Analyses by semi-quantitative spectrographic method are 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
755 analyses
PERCENT OF FREQUENCY
PARTS PER MILLION
B
10
100
1000
0
10
20
30
40
50

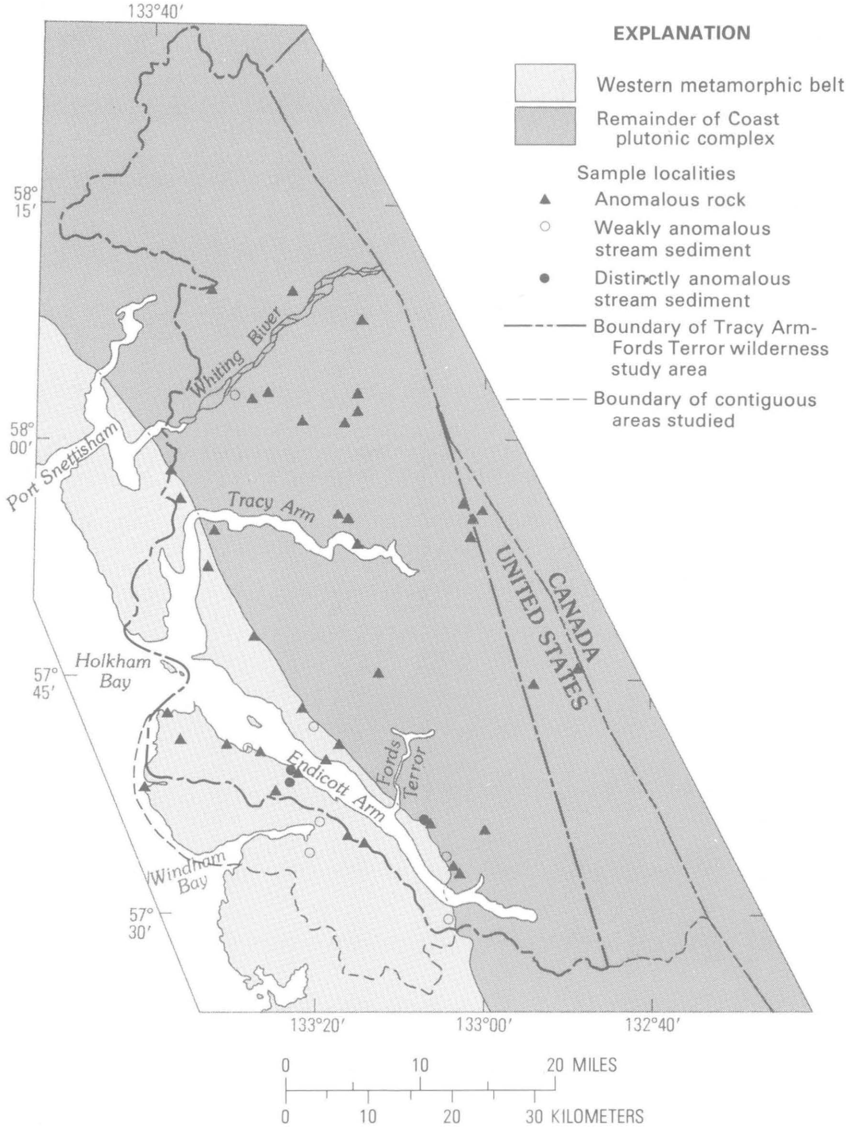
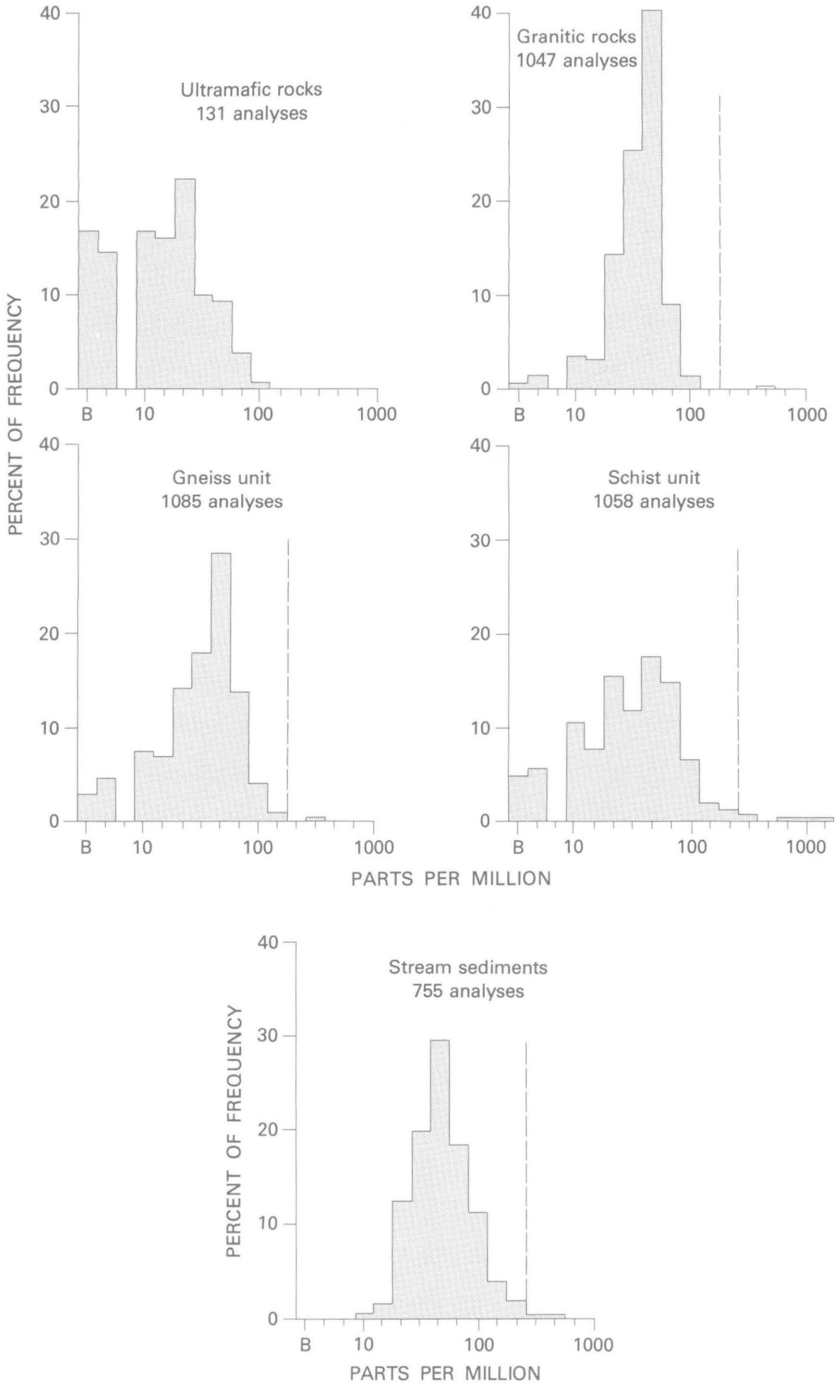


FIGURE 15.—Location of rock and stream-sediment samples containing anomalous lead.

FIGURE 16 (facing page).—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, 7). Analyses by atomic absorption are 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
PERCENT OF FREQUENCY
PARTS PER MILLION
Stream sediments
755 analyses
PERCENT OF FREQUENCY
PARTS PER MILLION
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1000

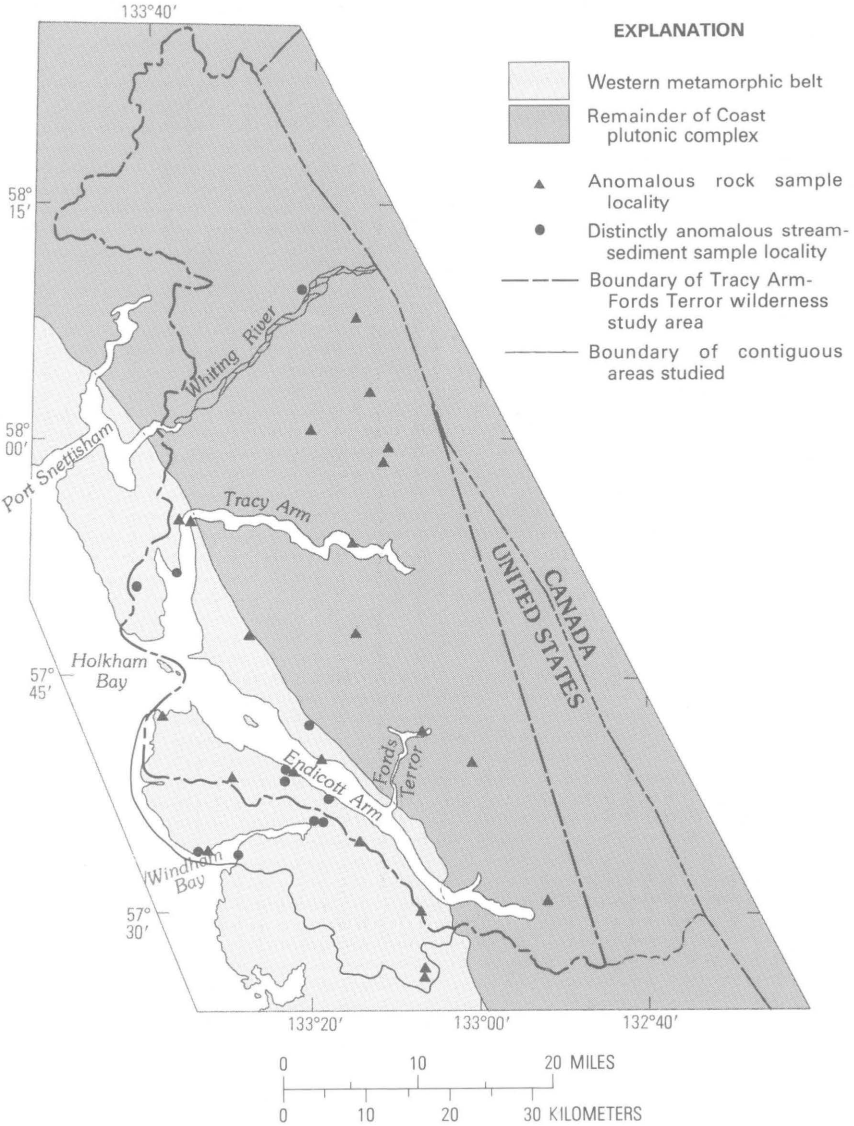

FIGURE 17.—Location of rock and stream-sediment samples containing anomalous zinc.

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 rock and stream-sediment samples anomalous in zinc (fig. 17) indicate a concentration in the western metamorphic belt. However, the concentration is not pronounced nor are the values so high as to suggest significant zinc occurrences.

CHROMIUM AND NICKEL

Many of the rocks in the study area have an unusually high chromium and nickel content (figs. 18, 19). Both these elements are preferentially concentrated in ultramafic rocks, and Levinson (1974) gave 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: basalt averages 200 ppm chromium and 150 ppm nickel, granodiorite 20 ppm chromium and nickel, and granite 4 ppm chromium and 0.5 ppm nickel. Most sedimentary rocks contain less than 100 ppm chromium (Thayer, 1973) and nickel (Cornwell, 1973). Although the rocks in the study area follow these patterns in general, many of the rock samples 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 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 incomplete data on the crustal abundance of chromium and nickel or 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. 18, 19) coincides with their average abundance in crustal rocks. Levinson (1974) indicated 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 (pl. 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 contents of the rocks and stream sediments in the study area (fig. 20) are well within normal background. Fleischer (1970) and Pierce, Botbol, and Learned (1970) showed a wide range in the mercury content of crustal material but indicated that most rocks and stream sediments contain less than 0.2 ppm mercury and that 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.

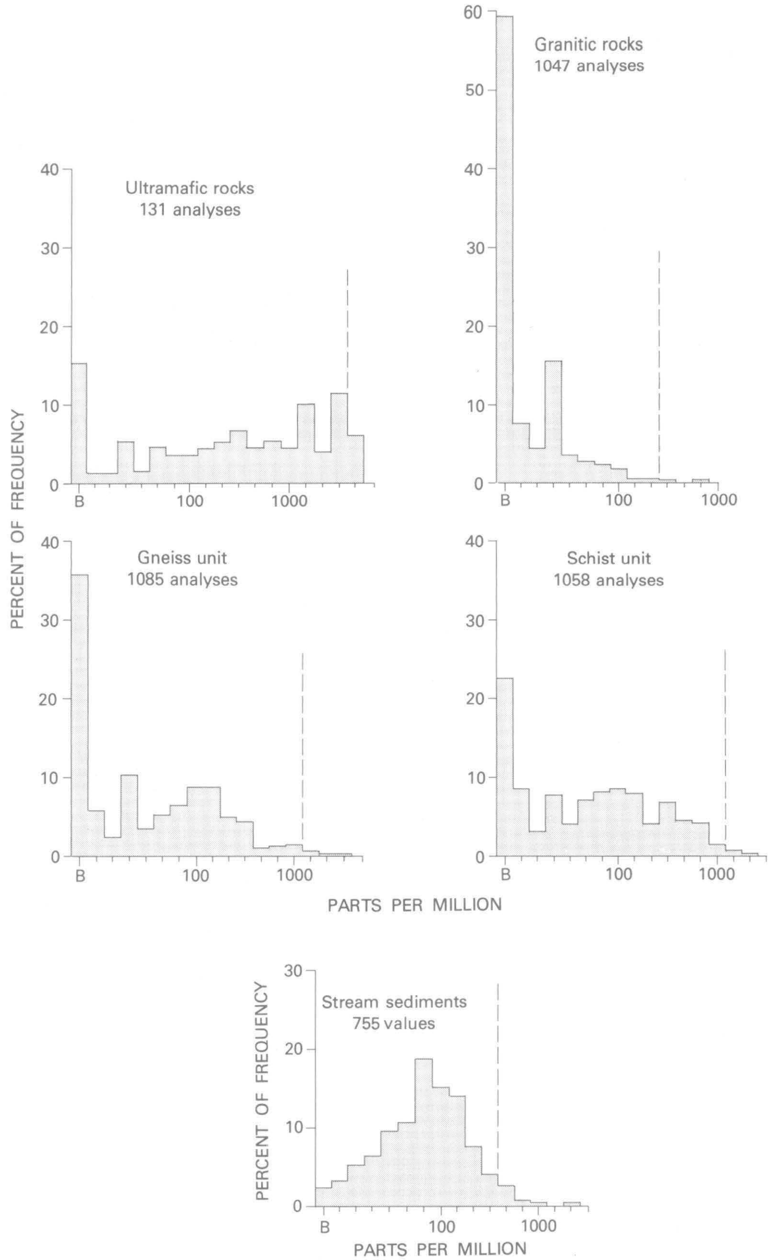

FIGURE 18.—Histograms of the distribution of chromium in rock and stream-sediment samples. Values to the right of the vertical dashed line are anomalous as defined in this report (tables 4, 7). Analyses by semiquantitative spectrographic method are reported in a six-step series utilizing the values ... 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.

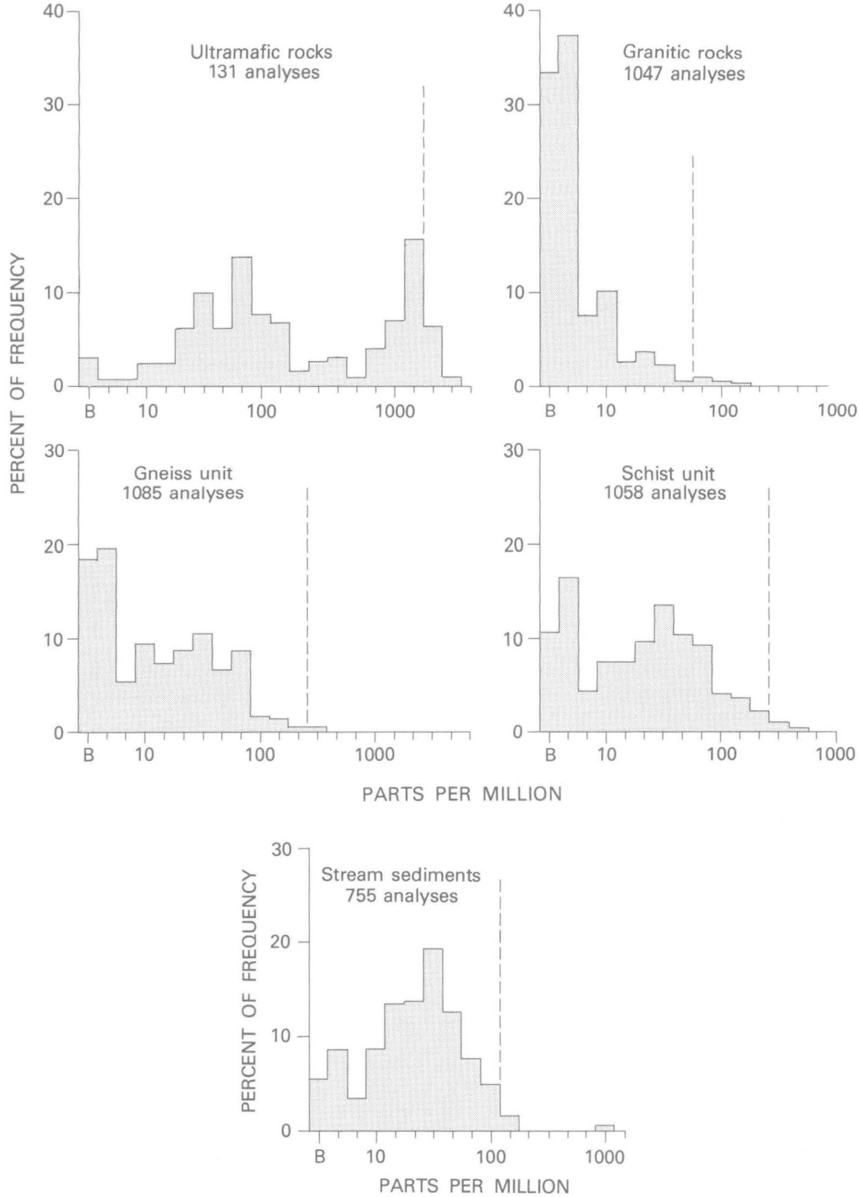

FIGURE 19.—Histograms of the distribution of nickel in rock and stream-sediment samples. Values to the right of the vertical dashed line are anomalous as defined in this report (tables 4, 7). Analyses by semiquantitative spectrographic method are reported in a six-step series utilizing the values . . . 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.

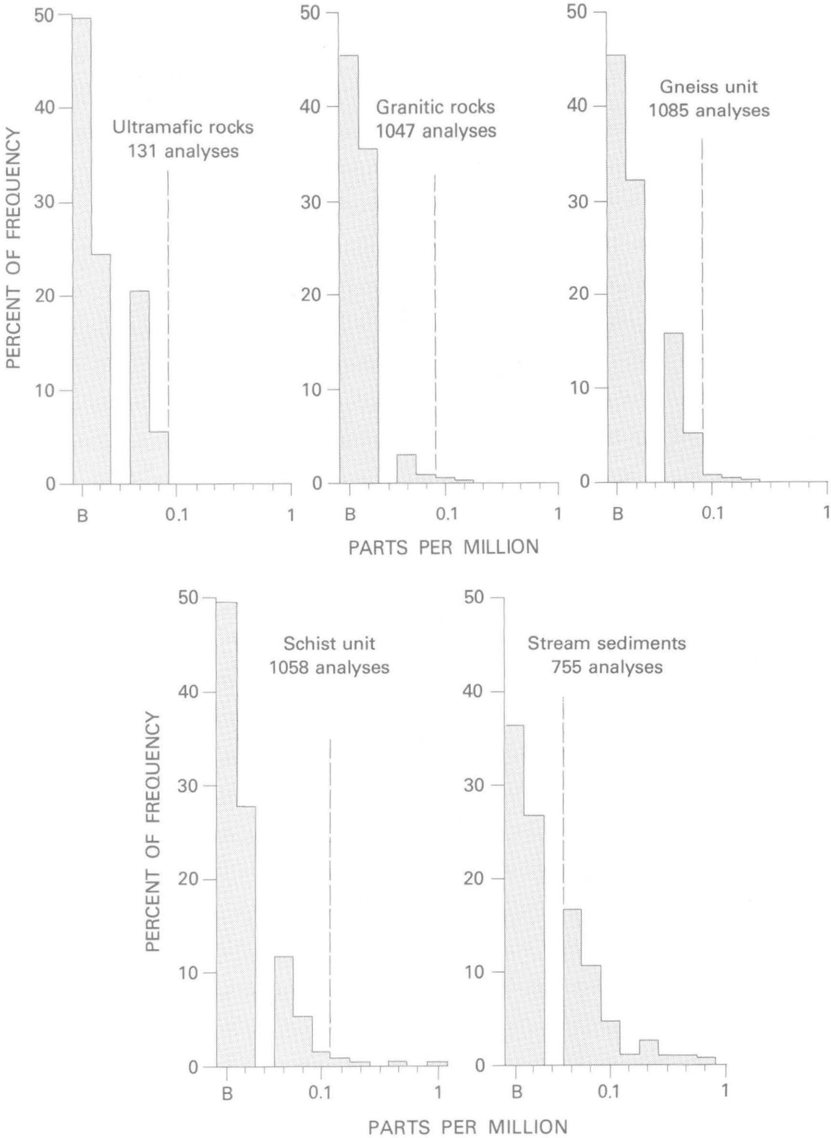

FIGURE 20.—Histograms of the distribution of mercury in rock and stream-sediment samples. Values to the right of the vertical dashed line are anomalous as defined in this report (tables 4, 7). Analyses by mercury vapor detector are reported in a six-step series utilizing the values . . . 0.1, 0.15, 0.2, 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.

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.

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 pegmatite dike 1 m (3 ft) wide and 30 m (100 ft) long, which is located about 4 km (2.5m) south of the terminus of the Dawes Glacier, contains scattered beryl crystals up to 15 cm (6 in) long, but this occurrence is apparently unique in the area.

Levinson (1974) indicated 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 3–4 ppm in granite, shale, 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. 21) in rock and stream-sediment samples of the study area shows no pronounced patterns. Most of the anomalous samples are from near the head of Endicott Arm. 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.

URANIUM AND THORIUM

There has been no production of uranium or thorium from this area nor is there any prospect that contains either metal 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 were analyzed by neutron activation analysis. Only 212 of the analyses were acceptable; they are presented in table 10. Noteworthy samples are described in table 11. In addition, all the rock and stream-sediment samples were routinely scanned with a scintillation counter; none were significantly above background.

Figure 22 indicates the location of 38 samples with more than 5 ppm uranium or 15 ppm or more thorium. Most of these samples are from the main part of the Coast plutonic complex, as might be expected. Granitic rocks and associated gneiss and migmatite generally have the highest uranium and thorium content of the common

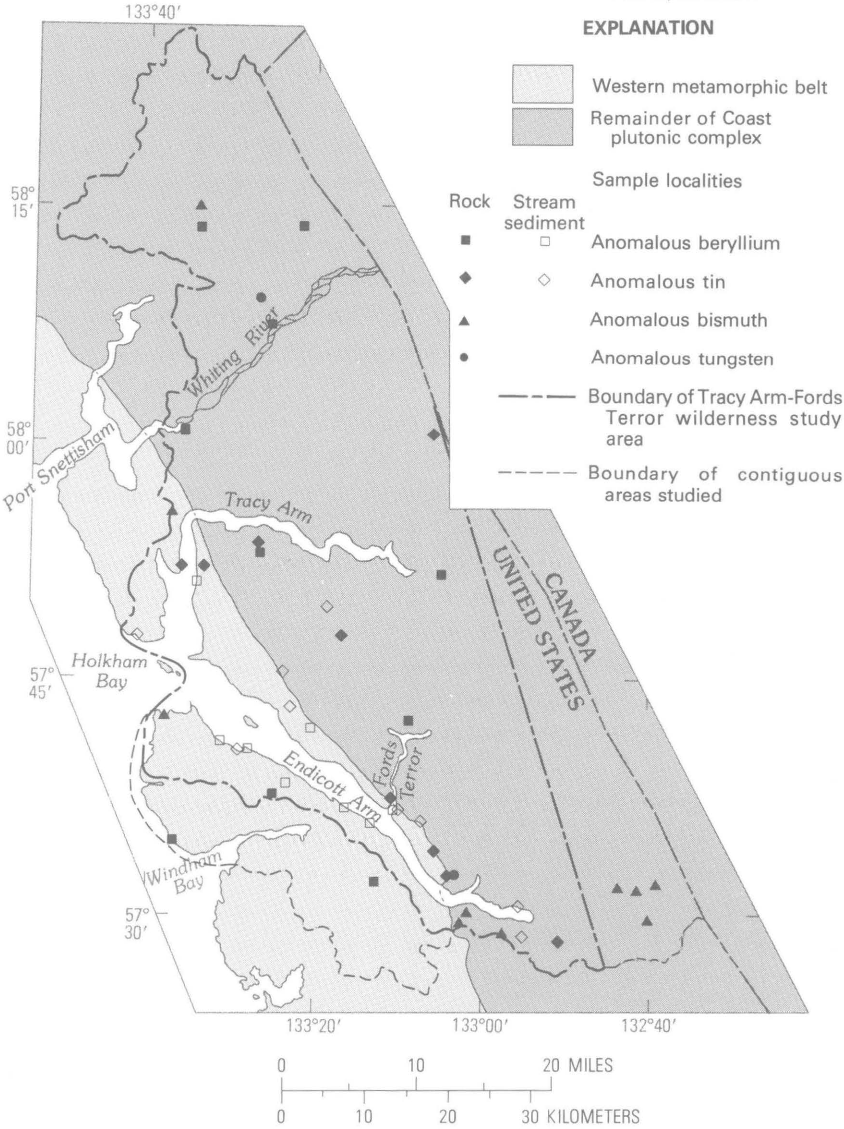

FIGURE 21.—Location of rock and stream-sediment samples containing anomalous beryllium, tin, bismuth, and tungsten.

rocks. Rogers and Adams (1969a, b) indicated that most silicic igneous rocks contain about 3–10 ppm uranium and 10–20 ppm thorium. Levinson (1974) indicated an average crustal abundance of 2.7 ppm for uranium and 10 ppm for thorium.

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.

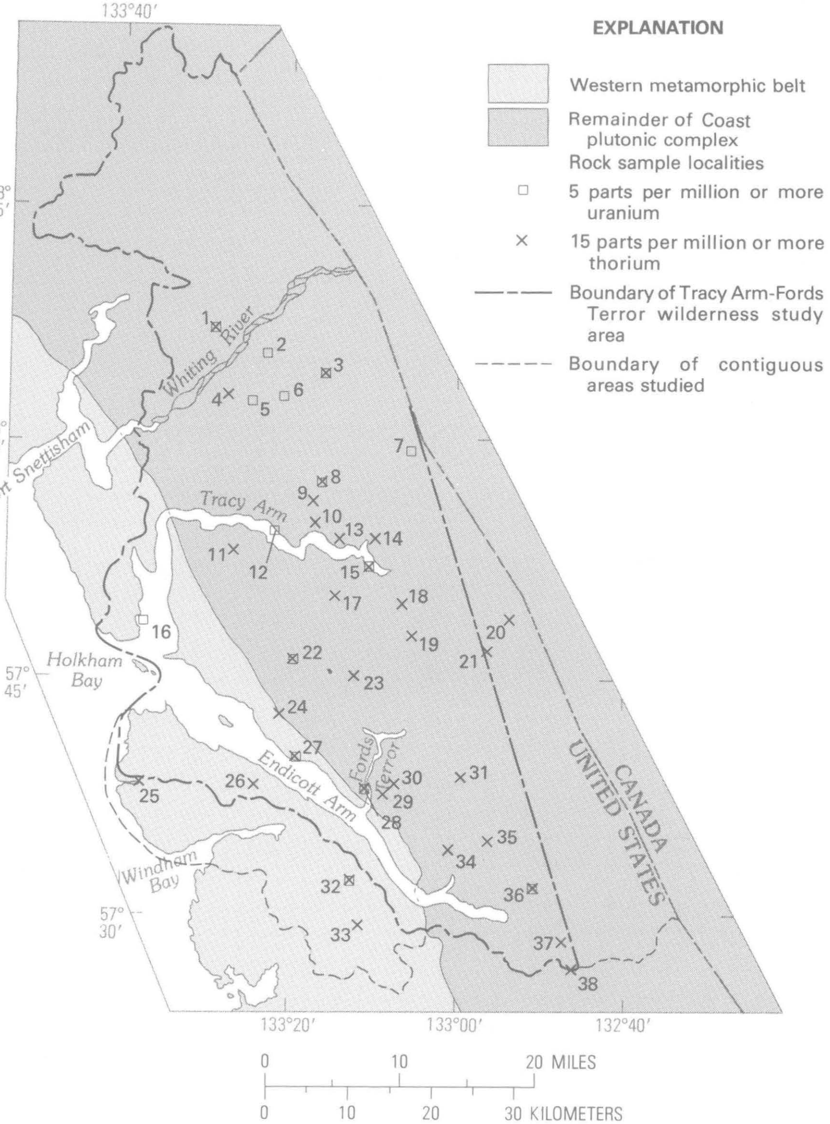

FIGURE 22.—Location of rock samples containing anomalous uranium and thorium. Map numbers refer to analyses cited in table 10.

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 near the average crustal abundance. The samples analyzed during this study indicate that the area probably has no significant uranium and thorium mineralization. The sampling indicates almost no potential for a large low-grade uranium-thorium resources, such as is associated with the Conway Granite of New Hampshire, although small vein deposits may be present and as yet undetected.

RELATIONS OF TRACE ELEMENTS IN ROCKS

The analytical data were treated statistically to determine the correlation coefficient for each pair elements. The correlation coefficient for any pair of elements indicates how closely their relation approximates a positive or negative linear function. Thus, a correlation coefficient of 1 (or -1) indicates that as the amount of one element increases, the other increases (or decreases) in proportion, or that if the analyses for two elements are plotted on a graph the data points could be connected by a straight line. A correlation coefficient of 0 indicates that a plot is a random scatter of points.

The correlation matrix in figure 23 is a measure of the relations 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 in figure 23 exceed 0.5; this is at least partly due to the great diversity of rock types and mineralized samples collected during this study.

The trace-element relations in this area are considered as those that are related to the usual geochemical relations in rocks and 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 relation that is characteristic of ultramafic rocks and in this area, as elsewhere, persists through the geochemical cycle. Similarly, the relation of niobium to beryllium, lanthanum, yttrium, and zirconium—and to some extent each of these to each other—represents a basic geochemical association that is reflected in Goldschmidt's (1954) lithophile group 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, which suggests 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 relation to the silicic igneous rocks of the Coast Range batholithic complex. The remaining strong correlations—molybdenum with vanadium, and scandium with colbalt, 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 between -0.15 and -0.299 is so low that any interpretation is suspect. Some correlations—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, such as chromium with barium or yttrium, probably represent some basic geochemical trend, but the relations are speculative. Some of the relations 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.

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	Ag	Au	B	Ba	Be	Co	Cr	Cu	Fe	Hg	La
Ag	Ag										
Au	0.5696 (9)	Au									
B	−0.0478 (104)	0.0386 (15)	B								
Ba	−0.0956 (228)	0.1484 (31)	−0.0074 (589)	Ba							
Be	0.0432 (161)	−0.0732 (17)	0.0003 (416)	−0.0119 (2332)	Be						
Co	−0.0343 (223)	−0.1571 (26)	0.0262 (566)	−0.2422 (3651)	−0.0386 (2175)	Co					
Cr	0.0215 (225)	−0.0682 (21)	0.0046 (540)	−0.1636 (2587)	−0.0012 (1383)	0.4979 (2659)	Cr				
Cu	0.6571 (248)	−0.0418 (30)	0.0167 (569)	−0.0381 (3084)	−0.0147 (1640)	0.0556 (3051)	−0.0021 (2495)	Cu			
Fe	−0.0628 (271)	−0.2024 (131)	−0.0371 (639)	−0.1114 (4099)	−0.0426 (2409)	0.6363 (3881)	0.1951 (2806)	0.0179 (3331)	Fe		
Hg	0.1698 (177)	0.0117 (22)	−0.0312 (362)	−0.0170 (2146)	−0.0130 (1226)	0.0255 (2048)	0.0020 (1469)	0.2569 (1754)	−0.0120 (2314)	Hg	
La	0.1316 (153)	0.1360 (16)	0.1410 (366)	0.1600 (2326)	0.1948 (1746)	−0.0568 (2171)	−0.0208 (1459)	−0.0373 (1727)	0.0082 (2419)	−0.0017 (1250)	La

EXPLANATION

>50 pairs	<50 pairs	
0.0186 (3068)	0.5473 (44)	Correlation coefficient of >0.3 or <−0.3
0.2277 (3628)	0.1800 (22)	Correlation coefficient of 0.15 to 0.299 or −0.15 to −0.299

	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)
Mo	0.0284 (110)	−0.0000 (3)	−0.0682 (134)	−0.1480 (402)	−0.0179 (311)	−0.0278 (409)	−0.0206 (391)	0.0218 (402)	0.0407 (465)	0.0601 (226)	−0.0766 (301)											
Nb	0.1800 (22)	−0.0000 (7)	0.2623 (53)	0.0043 (196)	0.5273 (168)	0.0886 (193)	−0.0781 (164)	0.2396 (161)	0.0532 (209)	0.0239 (104)	0.4170 (183)	0.1469 (41)										
Ni	−0.0381 (246)	−0.1257 (27)	−0.0124 (583)	−0.1236 (3344)	−0.0136 (1908)	0.4625 (3321)	0.8610 (2644)	−0.0034 (2933)	0.1428 (3586)	0.0120 (1871)	−0.0017 (1930)	−0.0333 (425)	−0.0416 (181)									
Pb	0.6705 (234)	0.9851 (29)	−0.0136 (527)	−0.0193 (3053)	0.0010 (1852)	−0.0165 (2982)	−0.0040 (2217)	0.1391 (2575)	−0.0215 (3272)	0.1124 (1765)	−0.0016 (1849)	−0.0064 (384)	0.0479 (176)	−0.0032 (2744)								
Sc	−0.0621 (248)	−0.3433 (28)	0.0559 (603)	−0.2572 (3658)	−0.0017 (2178)	0.4533 (3668)	0.1221 (2702)	0.0186 (3068)	0.6611 (3897)	−0.0371 (2058)	−0.0430 (2220)	0.0079 (444)	−0.1274 (203)	−0.0279 (3295)	−0.0253 (2997)							
Sn	0.1302 (11)	(0)	−0.2396 (19)	−0.0641 (41)	0.3589 (36)	−0.0709 (38)	−0.0118 (32)	−0.1423 (36)	0.5473 (44)	−0.2237 (17)	0.3588 (36)	−0.1811 (11)	0.0607 (11)	−0.0546 (40)	−0.0677 (35)	0.2540 (40)						
Sr	0.0367 (204)	0.2165 (27)	−0.1529 (479)	0.2277 (3628)	−0.0257 (2203)	−0.0791 (3466)	−0.1371 (2456)	−0.0125 (2921)	0.0449 (3850)	−0.0175 (2017)	0.0854 (2224)	−0.0236 (386)	0.0275 (193)	−0.1308 (3093)	−0.0044 (2886)	−0.1397 (3487)	−0.1286 (32)					
V	−0.0654 (268)	−0.1860 (31)	0.0101 (637)	0.0285 (4001)	−0.0275 (2346)	0.1856 (3821)	−0.0375 (2792)	0.0040 (3280)	0.2895 (4293)	−0.0910 (2264)	−0.0615 (2391)	0.4653 (460)	−0.1554 (202)	−0.0526 (3538)	−0.0187 (3202)	0.3241 (3866)	−0.0958 (44)	−0.0552 (3788)				
Y	0.0356 (232)	−0.2643 (27)	0.0009 (589)	−0.0477 (3659)	0.0396 (2202)	0.1555 (3571)	0.0110 (2605)	0.0091 (3027)	0.2912 (3881)	−0.0126 (2079)	0.1532 (2255)	0.0432 (421)	0.4196 (207)	0.0310 (3217)	0.0044 (2953)	0.2724 (3653)	−0.2094 (41)	−0.0362 (3503)	0.1724 (3816)			
Zn	0.5170 (266)	0.0228 (32)	0.0127 (634)	−0.0117 (3983)	−0.0067 (2379)	−0.0143 (3804)	−0.0544 (2737)	0.2200 (3243)	−0.0164 (4268)	0.1819 (2284)	−0.0075 (2389)	0.0573 (453)	−0.0154 (207)	−0.0058 (3484)	0.1975 (3216)	−0.0443 (3820)	−0.0656 (43)	−0.0288 (3765)	0.1484 (4173)	0.0503 (3806)		
Zr	−0.0410 (264)	−0.1316 (29)	0.1181 (633)	0.1967 (4021)	0.0541 (2398)	−0.1017 (3802)	−0.1323 (2740)	−0.0266 (3229)	0.0202 (4266)	0.0000 (2251)	0.1795 (2399)	−0.0445 (457)	0.5056 (208)	−0.0754 (3483)	0.0071 (3178)	−0.1741 (3828)	−0.0975 (44)	0.0398 (3785)	−0.0610 (4175)	0.2514 (3841)	0.0279 (4154)	

FIGURE 23.—Correlation matrix for trace elements in rocks (4,428 samples). Number of data pairs are shown in parentheses beneath the correlation coefficients. Detection limits for each element are shown in parentheses along the abscissa. All analyses were by semiquantitative spectrographic methods except for five metals (Au, Cu, Hg, Pb, Zn), which were by atomic absorption methods.

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Mineral Deposits and Occurrences in the Tracy Arm–Fords Terror Wilderness Study Area and Vicinity, Alaska

By ARTHUR L. KIMBALL, JAN C. STILL,
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MINERAL RESOURCES OF THE TRACY ARM–FORDS TERROR WILDERNESS STUDY AREA AND VICINITY, ALASKA

GEOLOGICAL SURVEY BULLETIN 1525–E

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MINERAL DEPOSITS AND OCCURRENCES IN THE TRACY ARM–FORDS TERROR WILDERNESS STUDY AREA AND VICINITY, ALASKA

By ARTHUR L. KIMBALL, JAN C. STILL, and
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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 along the southwest side of the Coast plutonic complex. The majority of mineralization occurs in two zones: (1) on the 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 to Spruce Mountain opposite the mouth of Fords Terror.

The Endicott Peninsula produced about 25,000 oz 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, they may be linked with nearby felsic rocks that 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 schist.

The Sumdum Glacier mineral belt is characterized by copper-zinc-gold mineralization with minor lead. Copper, zinc, and a little silver dominate the deposits in the central and southeastern parts of the prospect belt. The major deposits in this part of the belt are the Sweetheart Ridge gold-copper prospect, Tracy Arm zinc-copper deposit, and the Sumdum copper-zinc prospect. In the latter two, 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 Tracy Arm and Sumdum 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 greenschist and phyllite to sericite near the southeastern end of the belt. Surface staining occurs widely throughout the belt.

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

The only previously known mineralization within the main part of the Coast plutonic complex is a single silver prospect south of the Whiting River. The geochemical anomalies that were investigated did not indicate significant additional mineralization within the 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 before this study was 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. 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. 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 no history of prospecting in the high parts of the Coast plutonic complex or of systematic geologic work there. The formidable terrain, extreme snowfall, poor weather, and 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 27,000 oz of gold and several thousand ounces of silver as determined from the literature and by inference based on field investigation. The study area proper produced 90–95 percent of this; the remainder came from the 88,000 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 24,000 oz 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 2,000 oz of placer gold were reported to have been produced from Powers Creek near Sumdum Glacier and Windham Bay (probably from Spruce Creek, at the head of the bay) in 1870–71, 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 oz of lode gold from the Jensen mine near Spruce Creek reported by Willis (1926), and another lot of less than 50 oz 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 with 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 proably 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 that 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 that 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.

The search for prospects and claims was conducted by helicopter, on foot, and by small powered skiff. Few claims could be identified on the ground. A few workings were found that could not be correlated with the available data. Some prospects referred to in the literature could not be found. The Sumdum Chief gold mine, which has been inactive 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 the 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; 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 and the lower limits of detectability for the quantitative measurability for these elements are listed in table 12. 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 the National Technical Information Service (NTIS) (Forn and others, 1977).

MEASUREMENT

Vein and sample widths and other field measurements were made in English units. English units have been retained in this chapter on mineral deposits and occurrences; whereas both English and metric units are used elsewhere in this report. Since measurements were made in English units, to use the metric "equivalent" alone would imply either a greater or lesser precision than that of the original measurement.

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, as 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 are in the Windham Bay addition. Most placer claims are situated in the addition. There were 97 known active claims in the area in 1975 (pl. 3); this total included 62 Sumdum Chief (copper) claims near Sumdum Glacier, 3 Sunny Day claims on Point Astley, 4 Iceburg claims on the former Sulphide prospect, the 24 Tracy claims covering the Tracy Arm zinc-copper prospect, and 4 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. Of the 26 that belonged to the State of Alaska through tax foreclosure, 15 lode and 4 placer claims 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 that has not been preserved. Some claims probably were never revisited after the year located; others were 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 wallrock. They could probably best be mined by underground methods. All lie within 2 miles of deep saltwater fiords, and 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 that affect local timber supply, and land acquisition problems that may arise.

Present mining costs in Alaska are nearly twice those of comparable metal mining in the conterminous 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–$75 per ton before it can be economically developed. Lower mining costs might be possible if larger ore bodies are present. Future advances in mining technology could reduce the minimum grade required to mine in this area.

The following sections 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 metal prices give in Engineering and Mining Journal (1976). The dimension and grade was inferred from selected available information to provide an overall picture of the deposit. Because no additional exploratory information is available, judgment can be used to adjust the tonnage and grade figures. Normal stoping width is not less than 4 ft wide. To determine minable material, high-assay veins of narrow widths are distributed over a 4-ft 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, 1927). From early descriptions of the property by Spencer (1906) and Buddington (1925), it is apparent there has been little or no physical development for many years. More recently, the prospect was examined by D. P. Banister in 1962 (unpub. data) and by Herreid and Race (1963). 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 long 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 No. 1 and Adit No. 2 (figs. 24, 25). The zones are separated by 700 ft of beach 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 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 northwest-trending mineralized zone was sampled at three sites on the wave-cut bench spaced over a distance of 400 ft; 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 ft section at extreme low tide on the wave-cut bench 150 ft 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 oz 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-ft-thick massive pyrite and sphalerite zone, gave 0.44 percent copper, 0.31 percent lead, and 9.0 percent zinc and values of 0.17 oz per ton gold and 1.45 oz per ton silver.

The southeast zone is exposed on the beach and in one of two short adits. The mineralization in Adit No. 1 is poorly exposed. On the surface the mineralized zone could not be traced. Adit No. 2, 200 ft to the south and approximately along strike, does not appear to

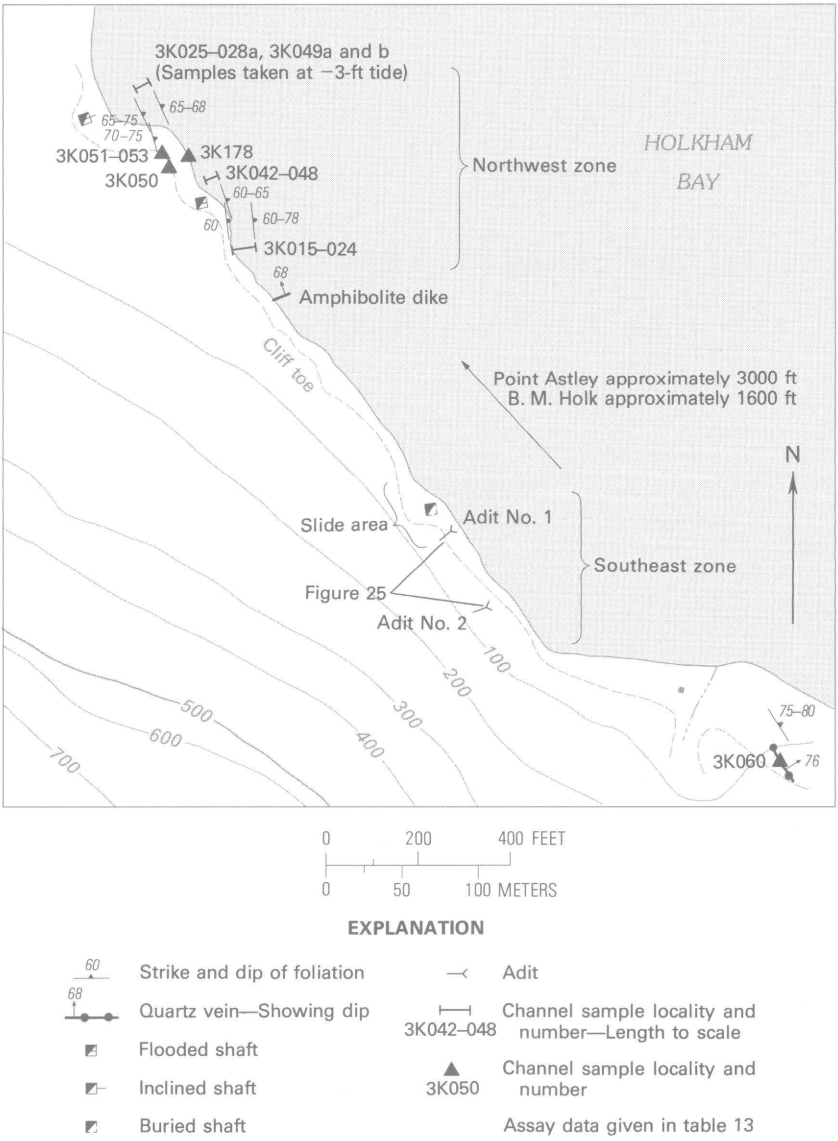

FIGURE 24.—Point Astley prospect, sample localities, and mineralized zones. Bedrock is chlorite phyllite. Mapped by T. L. Pittman and A. L. Kimball, June 1973.

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 No. 1 had weighted average values across a 30-ft section of 0.07 percent copper, 1.72 percent zinc, and 0.18 oz per ton silver. Lead values were insignificant. One 6-ft section of this group contained

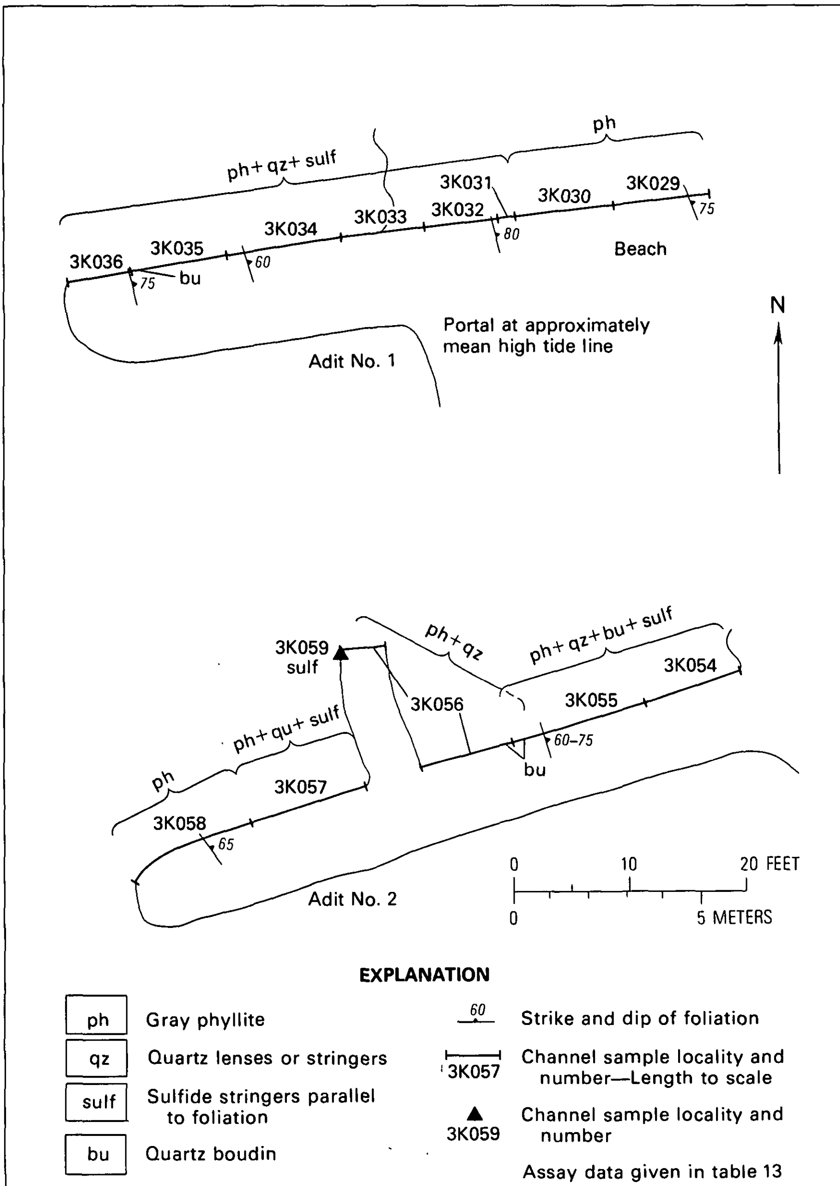

FIGURE 25.—Point Astley adits, sample localities. From map by D. P. Banister, (unpub. data, 1962).

4 percent zinc and 0.17 percent copper. Silver was reported as 0.59 oz 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-ft stretch of streambed between tideline and the 950-ft elevation. Seven of the fifteen samples contained 0.5 ppm silver each. Mineral-grain studies made on concentrates of samples from two localities 400 and 600 ft 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, copper, and silver. Little or no gold was present in the samples. Because the northwest and southeast zones of mineralization did not connect, 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 mineralization extends into that drainage or that separate concentrations of minerals occur there.

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

WINDHAM BAY AREA

SPRUCE CREEK LODES AND VICINITY

The rocks near the head of Windham Bay, the Spruce Creek drainage, and the south side of Spruce Mountain consist of steeply dipping schist or phyllite of the greenschist and greenstone map unit shown on plate 1 striking at about N. 20° W. 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 larger individual quartz veins that follow and occasionally cut the structure of the country rock. Quartz veins more than 3 in. wide that cross the structure consistently have the highest gold values. The 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, respectively (Spencer, 1906, p. 40). There is also a zone at the head of Windham Bay. Table 14 gives general information on prospects and individual workings investigated, and figure 26 is a general location map of the Spruce Creek area showing Spencer's zones of mineralization.

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 that range in length from 8 ft to 1,000 ft were located, mapped, and sampled. These adits were generally driven on quartz stringer zones and on large quartz veins, some parallel and others crosscutting 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 iron-stained zones between the Apache-Navajo prospect and the summit of Spruce Mountain, and from the altered zone on the south side of Spruce Mountain, indicate that the area may warrant further exploration. 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 oz per ton gold for a 68-ft-long section of vein over a 4-ft stoping width. The sample results contributing to this average grade were erratic. This grade of gold ore cannot be mined economically under present conditions because of small tonnage and remote location. One sample of the surface exposure of the Jensen underground vein system assayed at 2.77 oz per ton gold over a 4-ft stoping width and another assayed nil. 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. If the price of gold increases significantly, this area may warrant further prospecting. These deposits as now known are not exploitable 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 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 were driven on quartz veins or stringer zones in schist country rock. The best assay results from measured samples

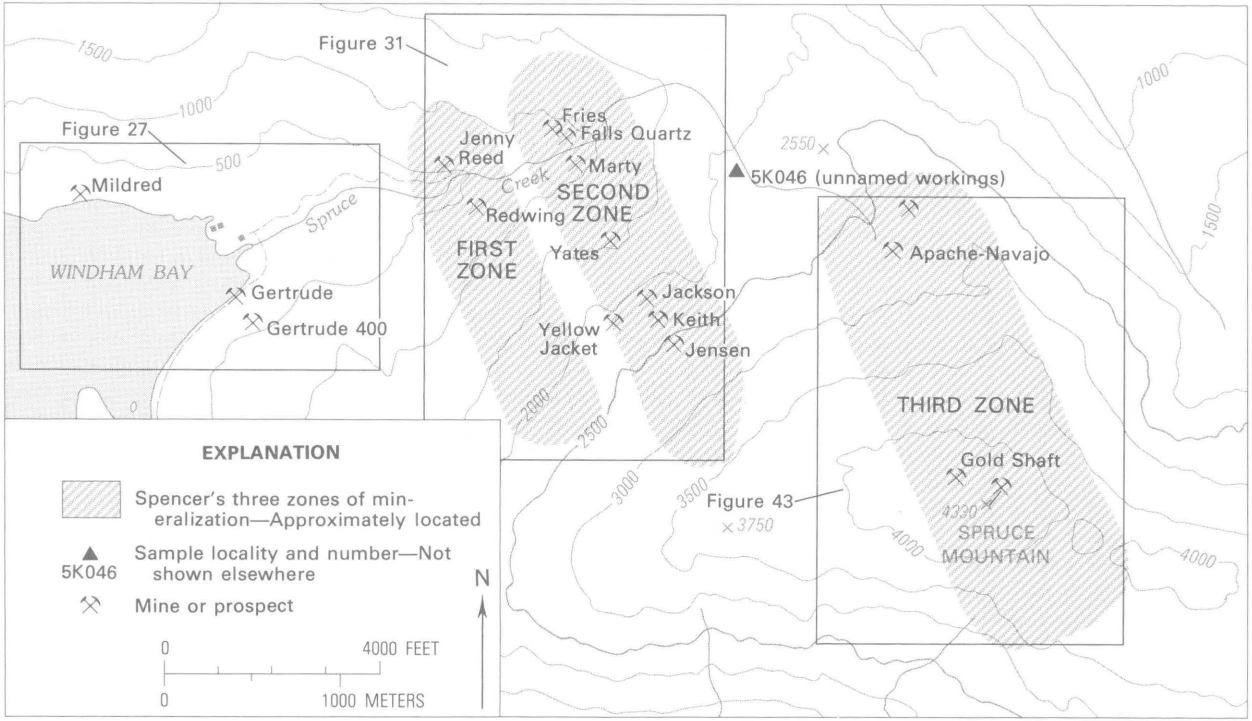

FIGURE 26.—Index map for Spruce Creek lodes. Bedrock is greenschist and greenstone or phyllite and slate. Base from U.S. Geological Survey 1:63,360, Sumdum C-5, 1951, and Sumdum C-4, 1961.

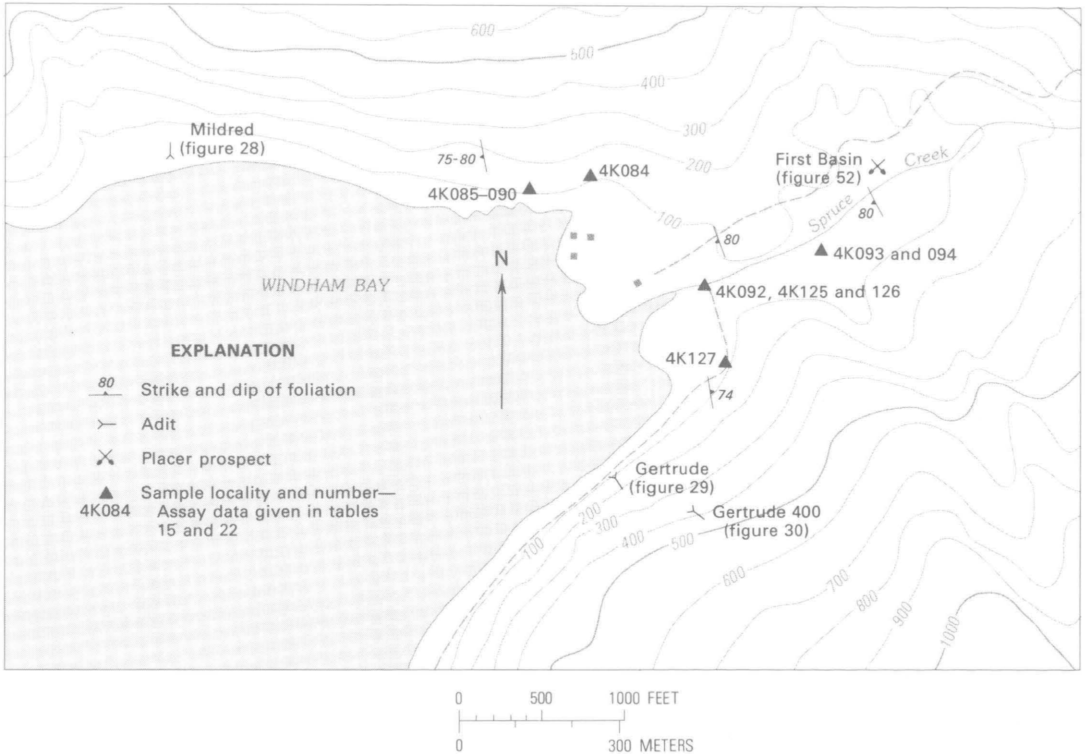

FIGURE 27.—Mineralized area near the head of Windham Bay, prospect and sample localities. Bedrock is greenstone and greenschist. Base from U.S. Geological Survey 1:63,000, Sumdum C-5, 1951, and Sumdum C-4, 1961.

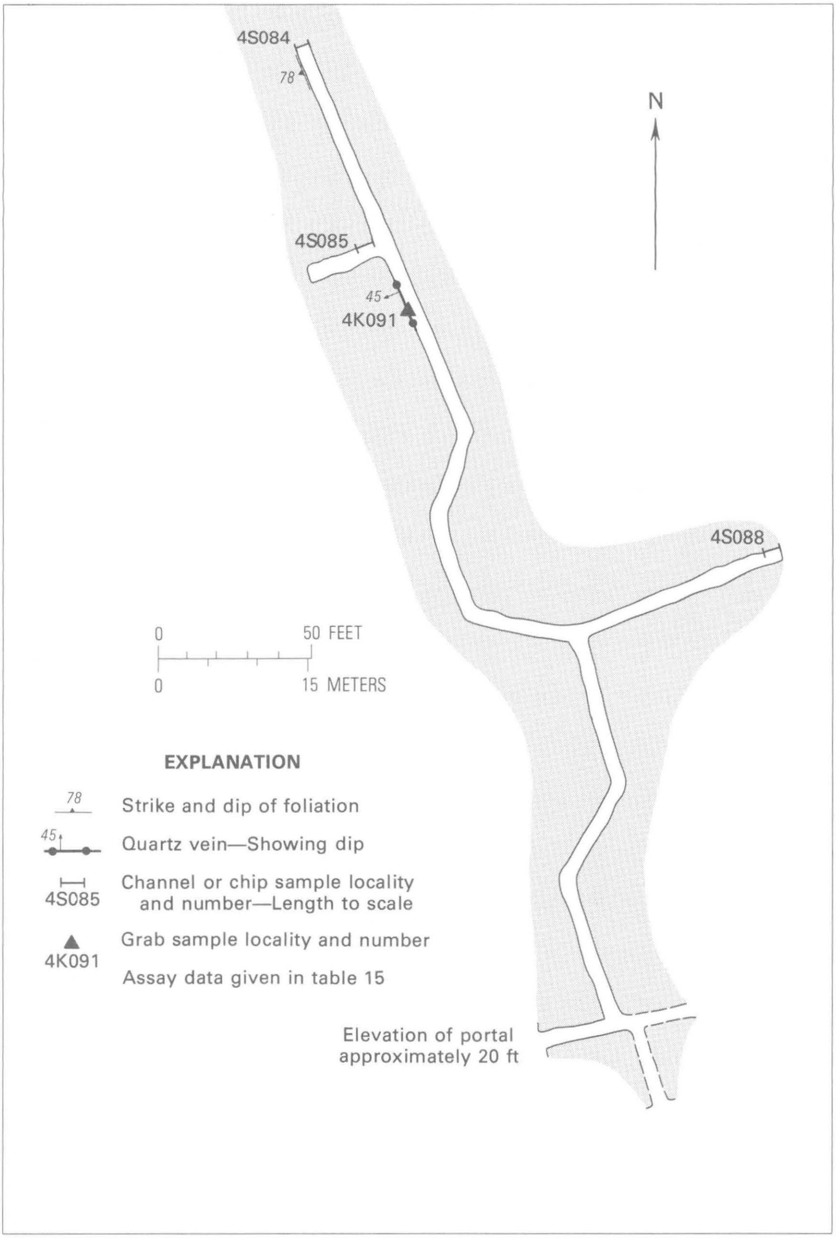

FIGURE 28.—Mildred adit, sample localities. Bedrock is muscovite schist. Mapped by J. C. Still, July 1974.

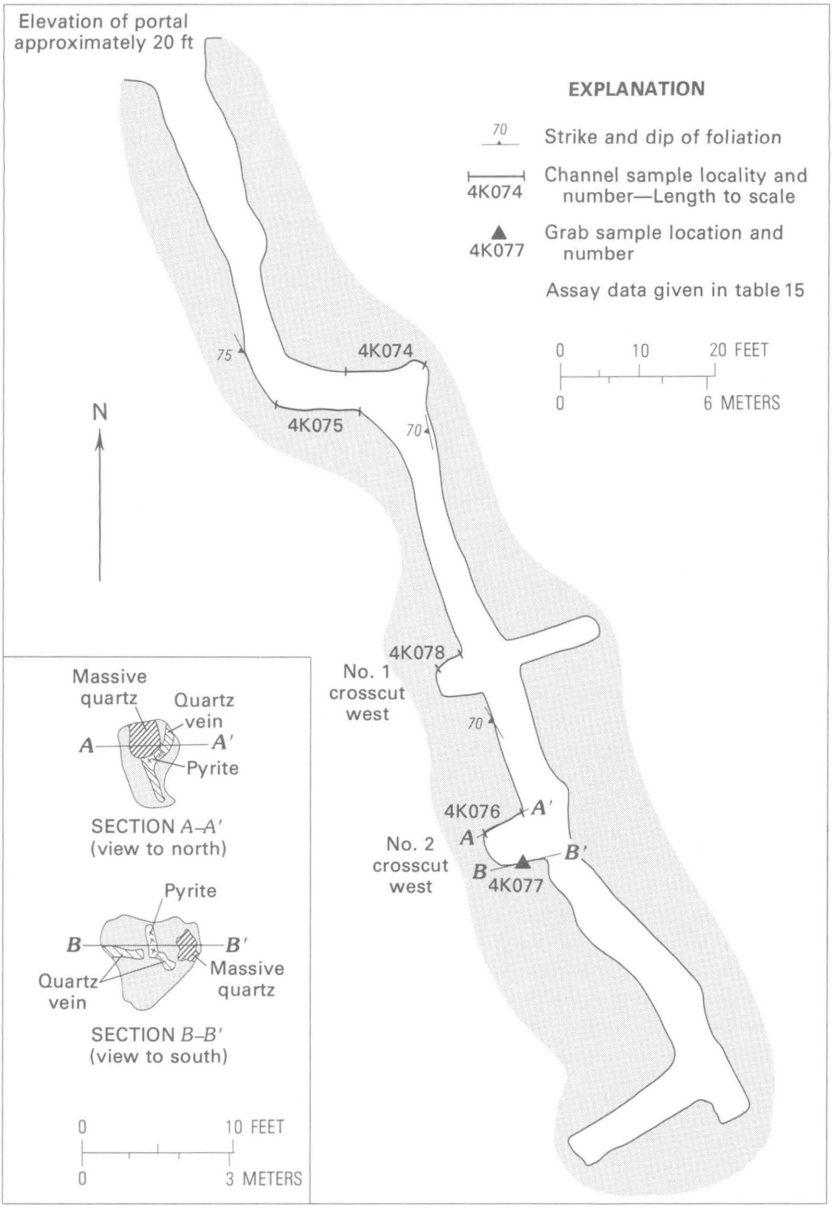

FIGURE 29.—Gertrude adit, sample localities. Bedrock is muscovite schist with quartz stringers parallel to foliation. Mapped by A. L. Kimball and M. A. Parke, July 1974.

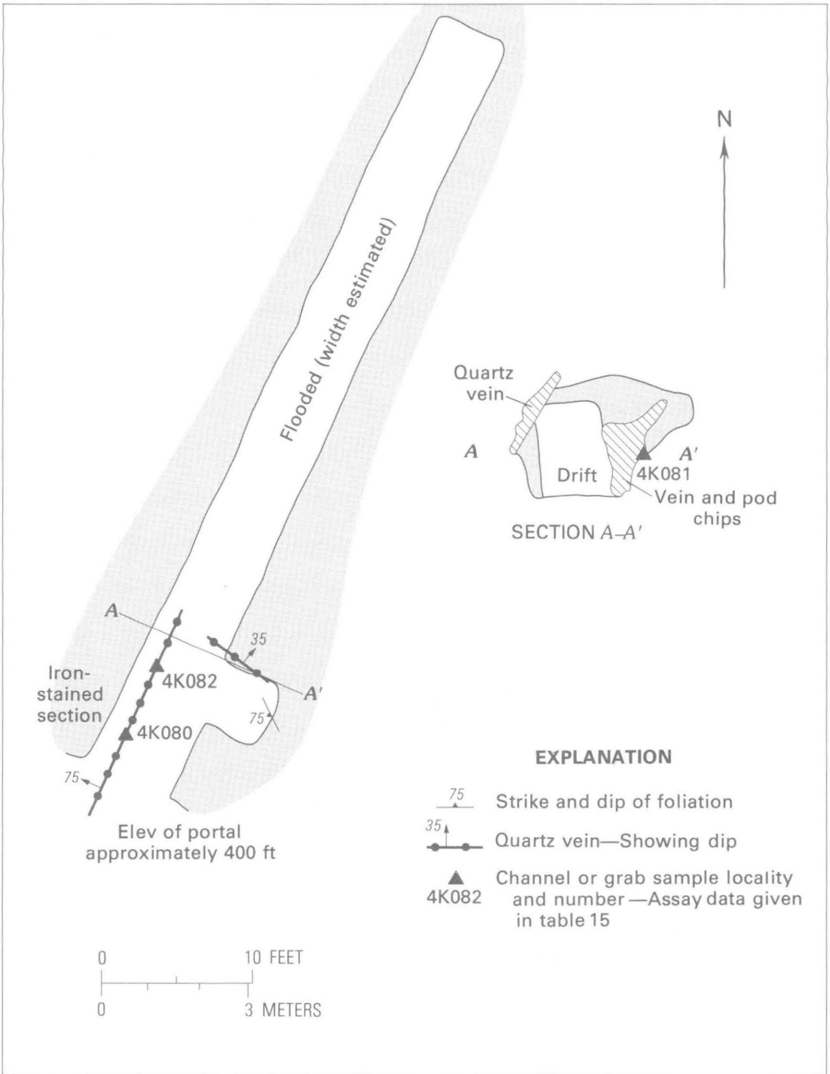

FIGURE 30.—Gertrude "400" adit, sample localities. Bedrock is phyllite schist with quartz veins and seams, some parallel to foliation. Mapped by A. L. Kimball and M. A. Parke, July 1974.

taken in the area were in the Gertrude adit. The best sample, a 6-ft-long channel, had 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.

SPENCER'S FIRST ZONE OF MINERALIZATION

A group of 12 patented claims is 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 significant sample in both adits was in Adit No. 1. A 7.4-ft-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 mill site, and an adit stoped out to a maximum height 10 ft. Figure 33 is a map of the workings, and table 16 gives the assay results. The adit stope was driven on a 1-ft-thick quartz vein, which crossed the foliation of the schist country rock, and contained some pyrite, pyrrhotite, sphalerite, galena, and chalcopyrite. Sample 4S069, a 1-ft channel across the quartz vein, assayed 30 ppm silver and 0.70 ppm gold. This was the highest value taken on the Red Wing property.

SPENCER'S SECOND ZONE OF MINERALIZATION

A group of claims known as the Marty group is located on the mineralized zone about 1.3 miles east of the head of Windham Bay. In the early 1920's, this group of claims was formed by consolidating 35 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 No. 1 and No. 2 (Fries adit), and the Falls Quartz (Falls Quartz adit). This claim group is primarily located along Spencer's second zone of mineralization 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 ft on the south side of Spruce Creek has become known as the Marty group.

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

This area has ten adits totaling 2,000 ft in length. Table 14 gives

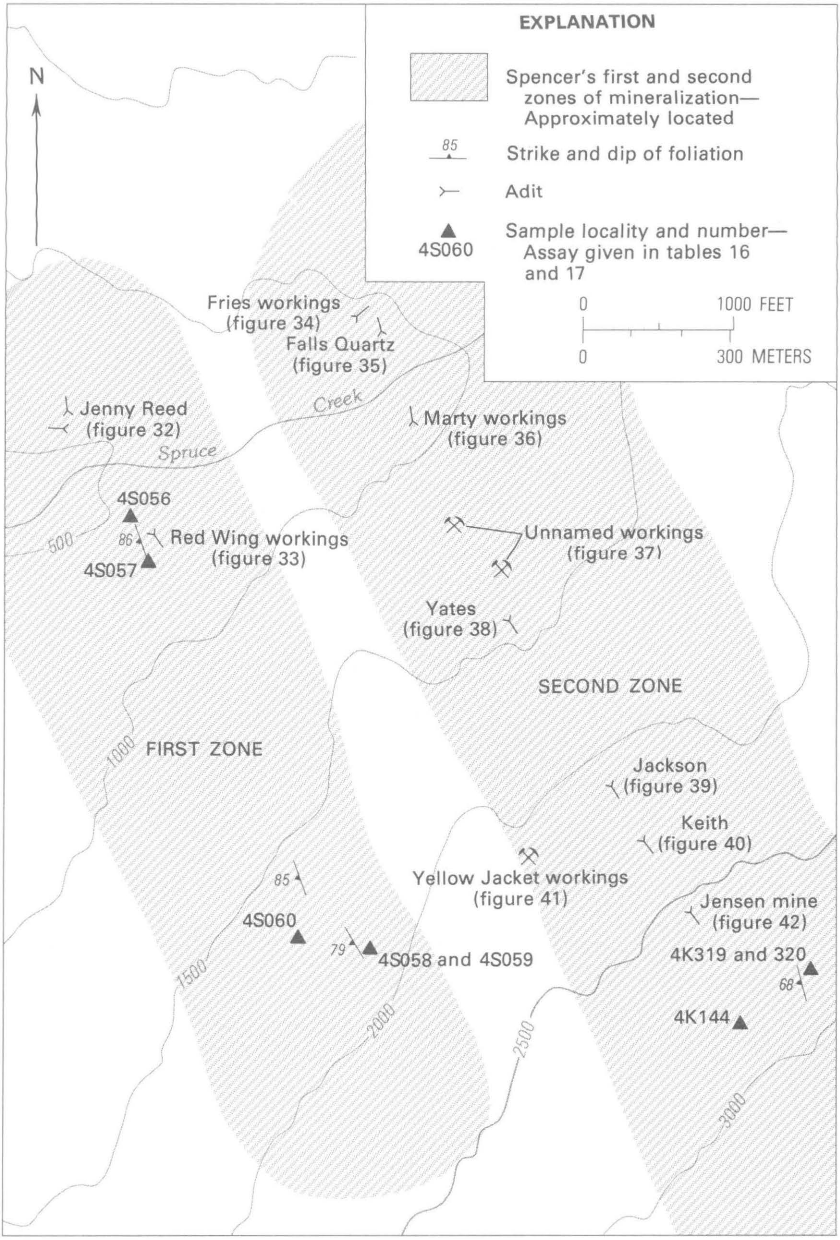

FIGURE 31.—Spencer's first and second zones of mineralization, prospect and sample localities. Bedrock is greenschist, greenstone, phyllite, and slate. Base from U.S. Geological Survey 1:63,360, Sumdum C-4, 1961.

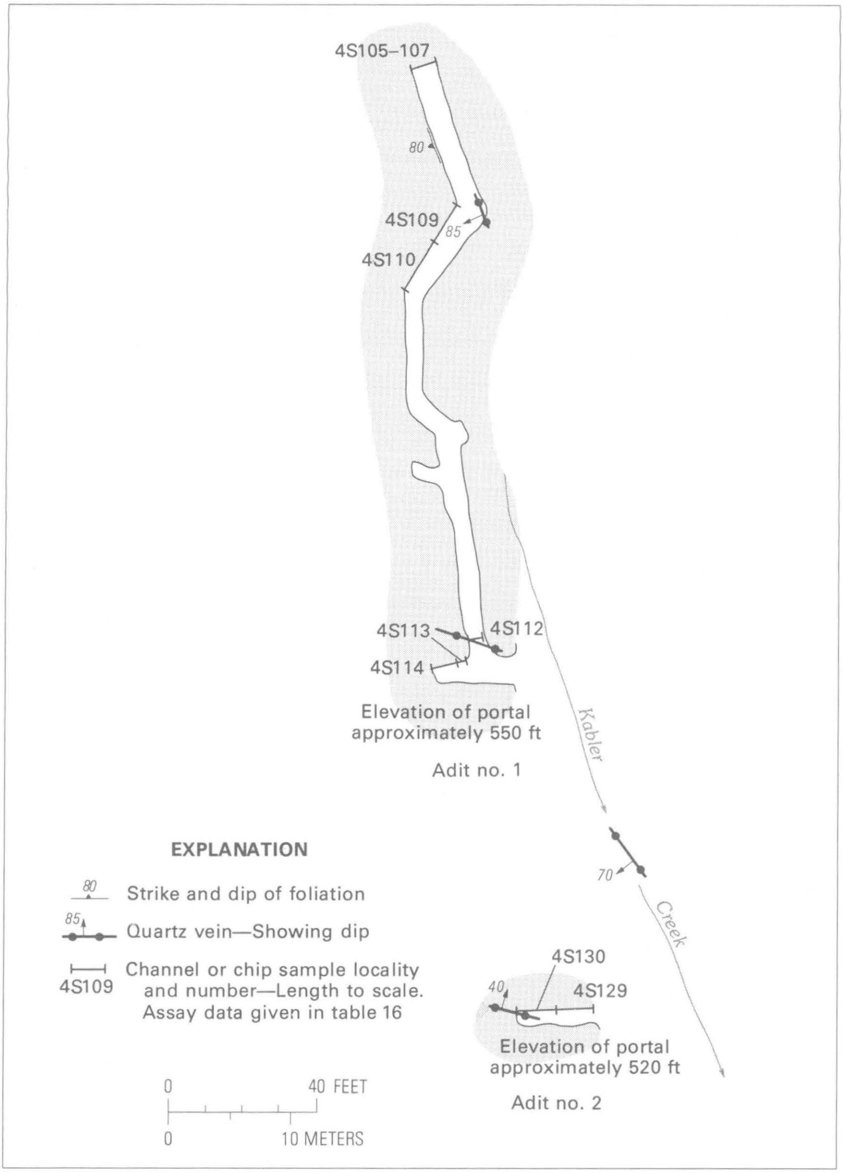

FIGURE 32.—Jenny Reed adits, sample localities. Bedrock is muscovite schist with quartz stringer zones with disseminated sulfides. Mapped by J. C. Still, F. R. Smith, and M. A. Parke, July 1974. Creek name from Mineral Survey plat number 1085, 1918, and is unofficial.

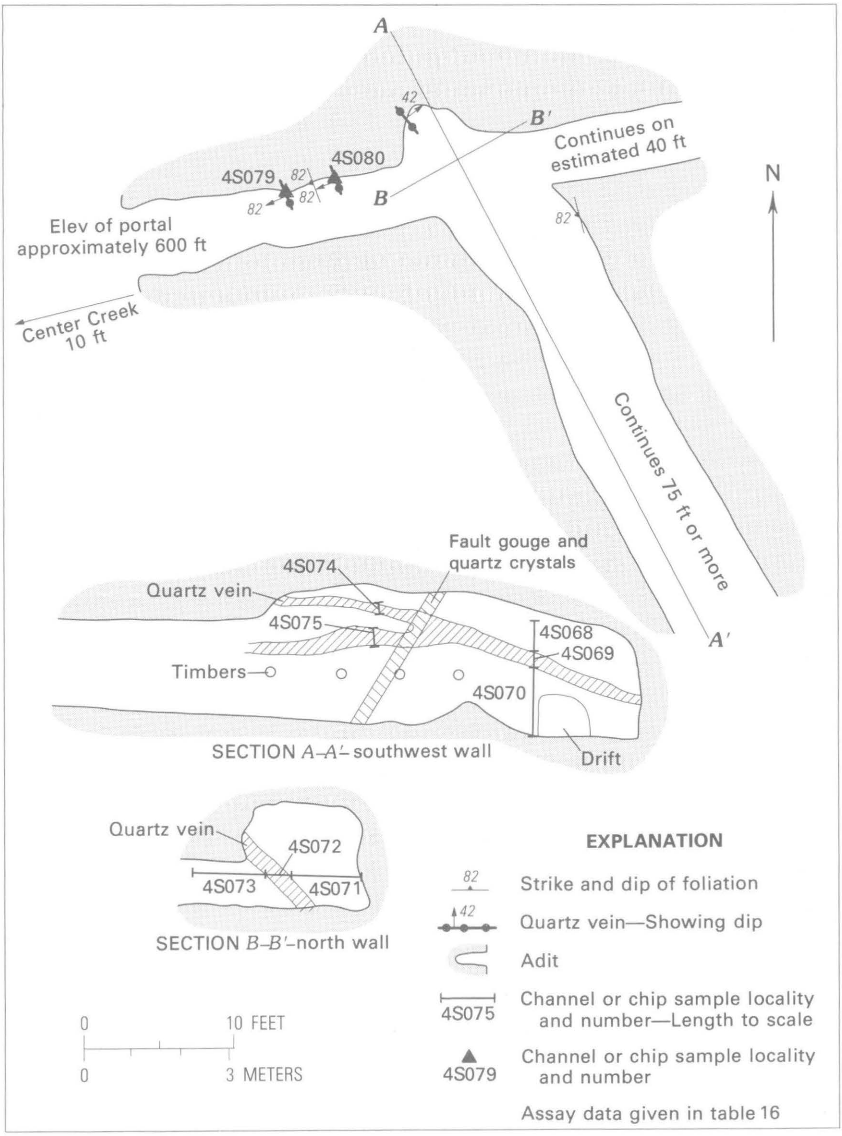

FIGURE 33.—Red Wing mine workings, sample localities. Bedrock is muscovite schist with quartz stringer zones. Mapped by J. C. Still and F. R. Smith, July 1974. Creek name from Mineral Survey plat number 577, 1903, and is unofficial.

a brief history of each adit. In about 1900, a 3,000-ft 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-ft long was erected between the Jensen adit and a Lane mill completed in 1926 on the north side of Spruce Creek (Willis, 1926, 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, except for 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 ft and 320 ft, 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. In Spencer's second zone of mineralization, the only significant gold values were found in the Jensen mine.

The Jensen mine is located at an elevation of 2,550 ft 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 0.5–1.5 ft 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-ft crosscut into a high-grade quartz stringer (Buddington, 1925, p. 126). By 1925, according to an unpublished Jacob Marty Mines report (Willis, 1926, p. 10), a 50-ft crosscut had been driven into the main vein and 40 ft of drift driven along the strike. In 1927, the main drift was driven to its present length of 275 ft. An aerial tramway was installed from the mine to the Marty mill, and 118 tons of hand-sorted ore were run through the mill with a recovery of $1,100 in gold (Willis, 1926, 1927 Supplement). Another source indicates that a small additional production came from this property. The mine appears to have been abandoned for over 40 years.

The mine 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 0.5–1.5 ft 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 locality map, and table 17 gives the assay returns. Eight samples from a 68 ft interval along the main vein had an average assay of 0.05 oz

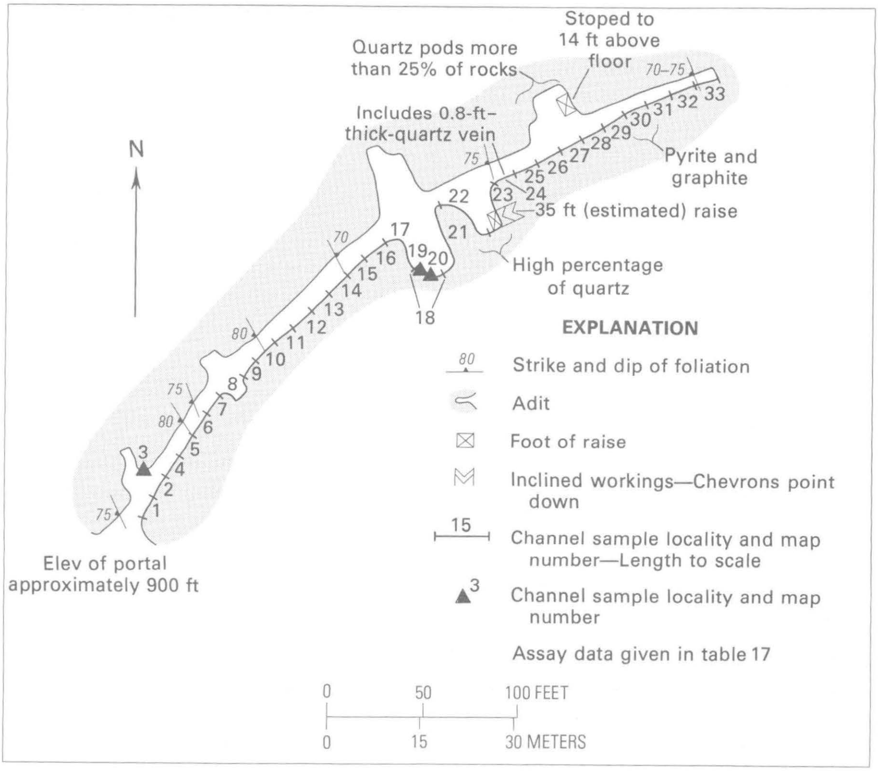

FIGURE 34.—Fries workings, sample localities. Bedrock is quartzose chlorite schist or muscovite schist with quartz banding parallel to foliation. Mapped by A. L. Kimball and M. A. Parke, July 1974.

per ton gold with a 4-ft stoping width. The vein system was sampled over a length of 275 ft.

The main vein was sampled at two locations on the surface. One sample assayed 16.98 oz per ton gold over a width of 0.65 ft or 2.77 oz per ton gold to a 4-ft stoping width. Another sample 97 ft to the southeast along the vein contained no gold. The first 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.

The assayed samples indicate that 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 north side of Spruce Creek south 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

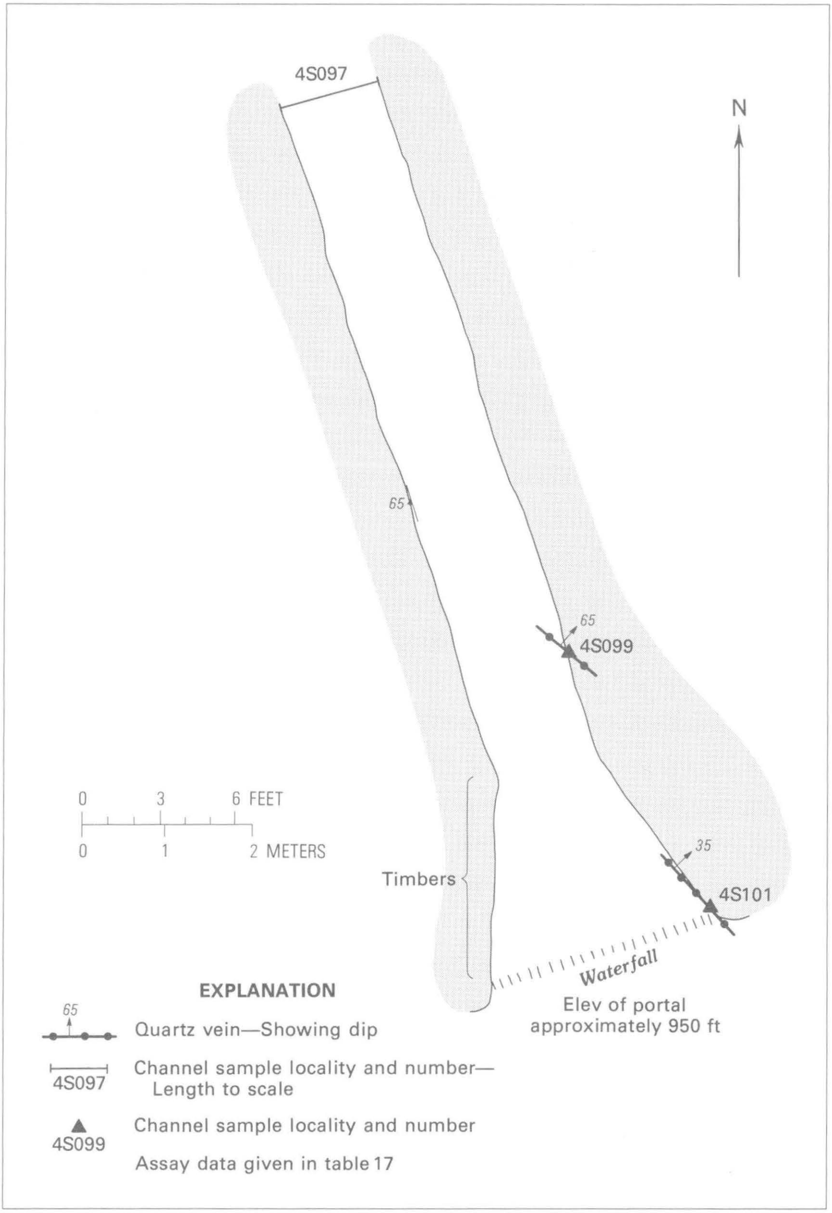

FIGURE 35.—Falls Quartz adit, sample localities. Bedrock is schist with quartz stringers zones. Mapped by J. C. Still and F. R. Smith, July 1974.

unpublished report states, "These ore deposts [Marty Group] bear no resemblance to the Alaska-Juneau either structurally, mineralogically, or economically and could not even be hand sorted on account

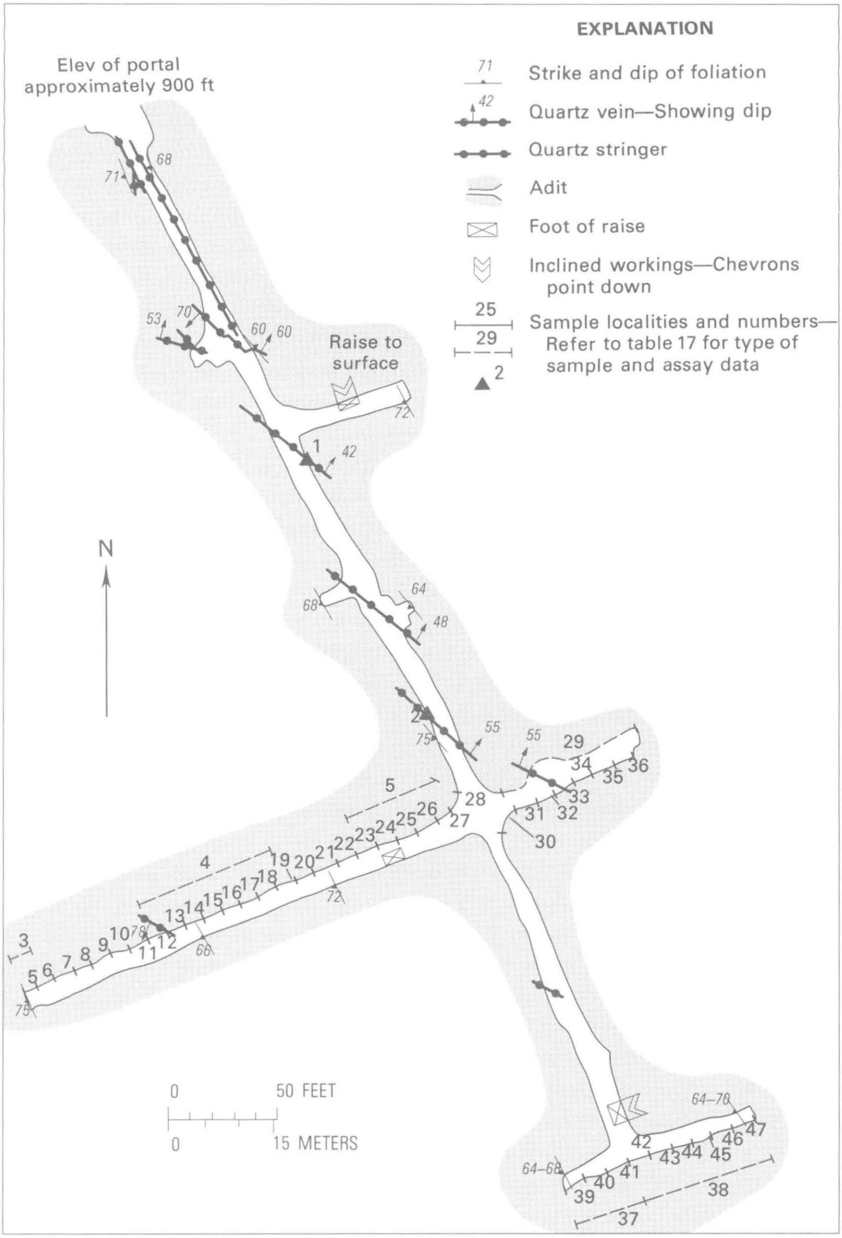

FIGURE 36.—Marty workings, sample localities. Bedrock is schist with quartz stringers parallel to foliation. Mapped by T. L. Pittman, October 1966.

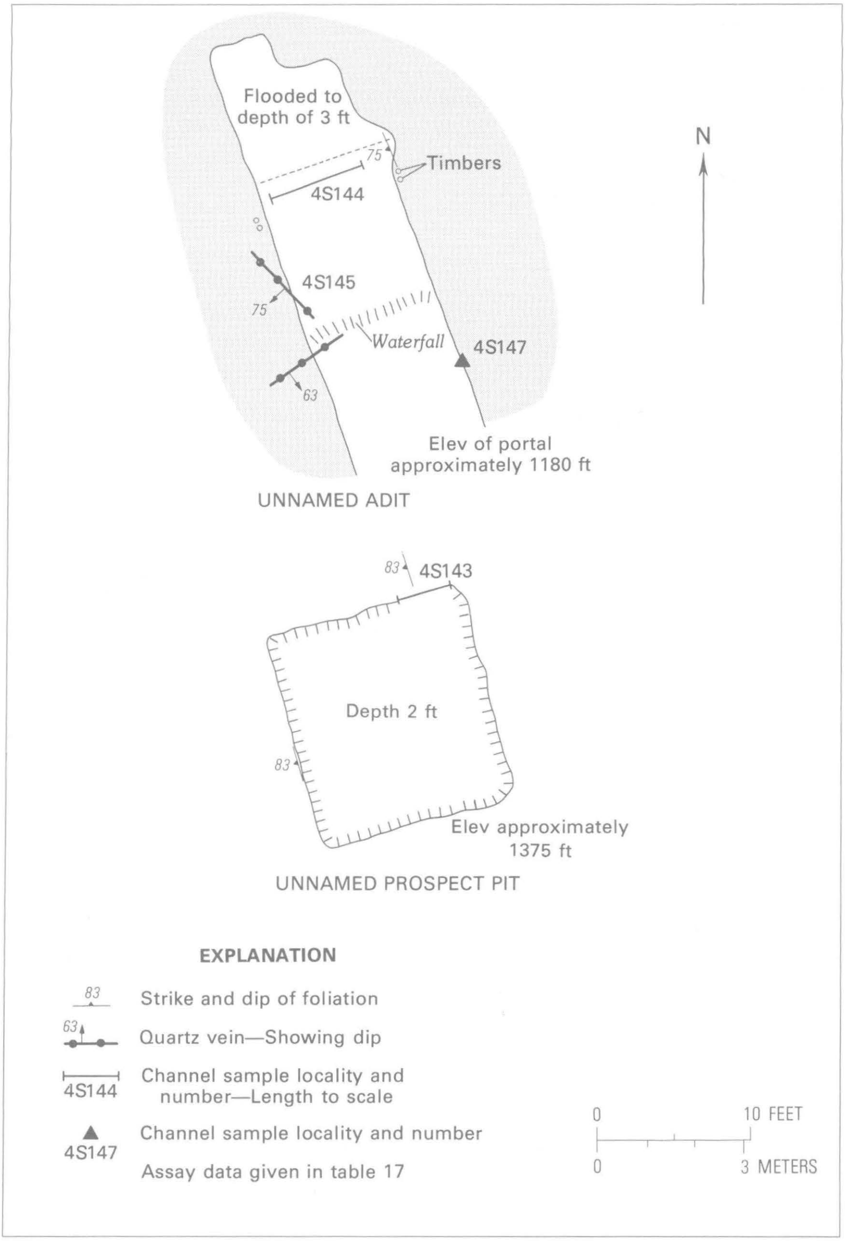

FIGURE 37.—Unnamed workings near Marty, sample localities. Bedrock is schist with quartz stringer zones. Mapped by J. C. Still and F. R. Smith, July 1975.

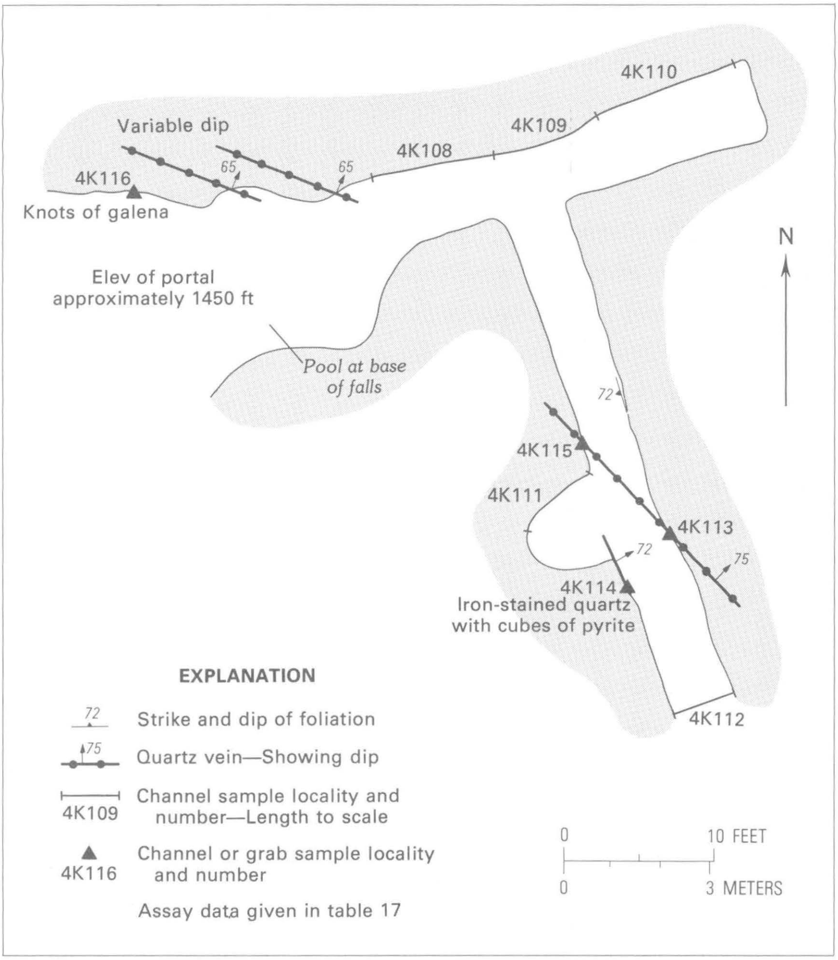

FIGURE 38.—Yates adit, sample localities. Bedrock is schist with quartz pods, stringers, and seams; some parallel to foliation. Mapped by A. L. Kimball and F. R. Smith, July 1974.

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 would be difficult to locate.

SPENCER'S THIRD ZONE OF MINERALIZATION

Spencer's third zone of mineralization extends from Spruce Creek at an elevation of 2,500 ft to the south side of Spruce Mountain. The Apache-Navajo prospect, iron-stained zones between the Apache-

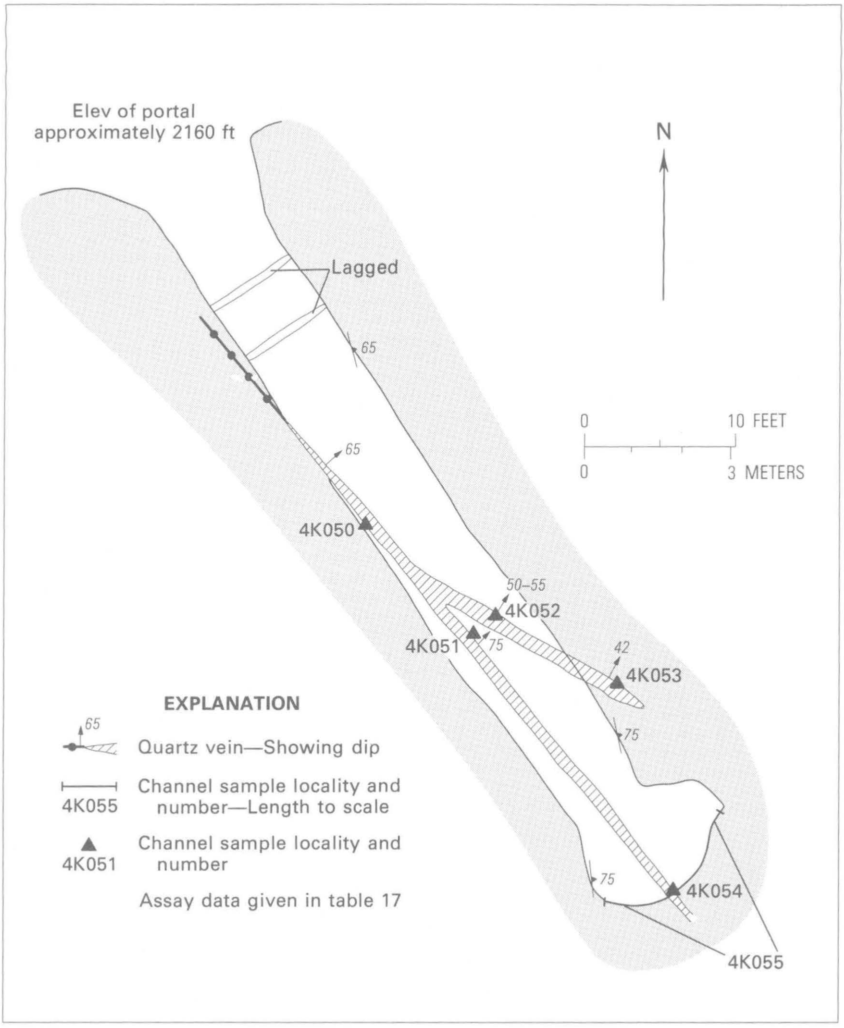

FIGURE 39.—Jackson adit, sample localities. Bedrock is muscovite schist with quartz stringers parallel to foliation. Mapped by A. L. Kimball and M. A. Parke, July 1974.

Navajo prospect and the summit of Spruce Mountain, the Gold Shaft prospect, an altered zone south of Spruce Mountain, and claims at the head of Sylvia Creek are all located within this mineralized area (fig. 43). The stained zones have base- and precious-metal 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.

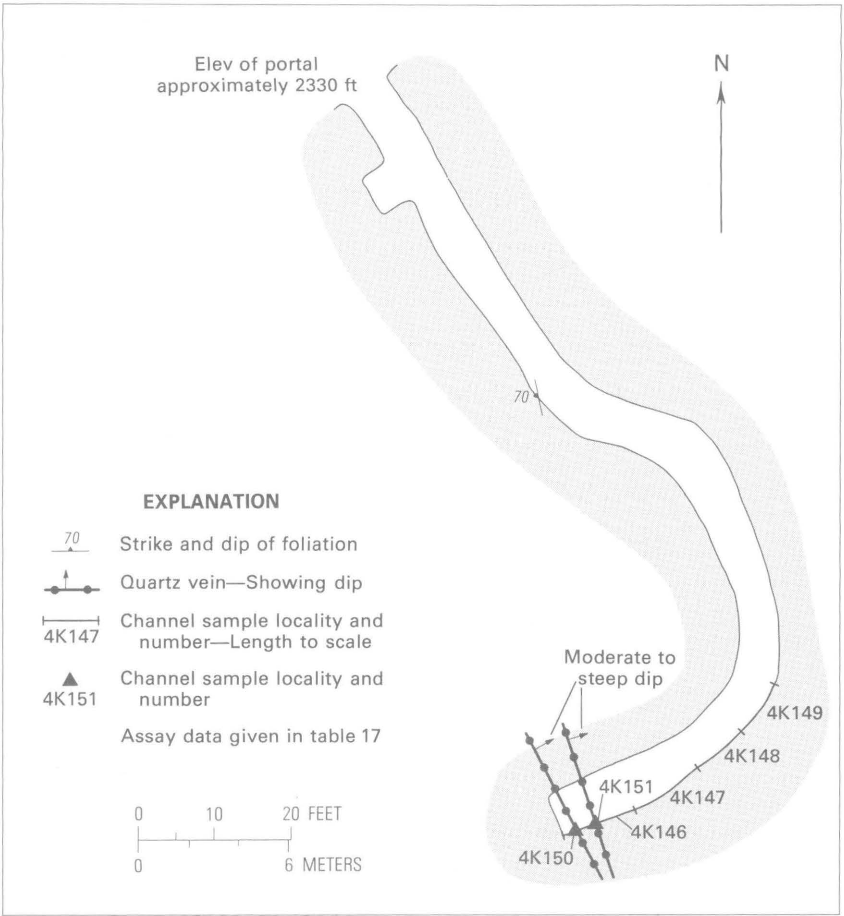

FIGURE 40.—Keith adit, sample localities. Bedrock is schist with quartz seams parallel to foliation. Mapped by A. L. Kimball and F. R. Smith, July 1974.

APACHE-NAVAJO PROSPECTS

The Apache and Navajo claims were patented in 1909 by the Windham Chief Gold Mining Company. They are located at the head of Spruce Creek. As of 1903, two adits 60 and 80 ft 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 then.

The two adits were driven on quartz veins. Figures 44 and 45 show the adits, and table 18 gives the sample assay results. There were no significant metal values present, and only traces of gold and silver were found in either of the adits.

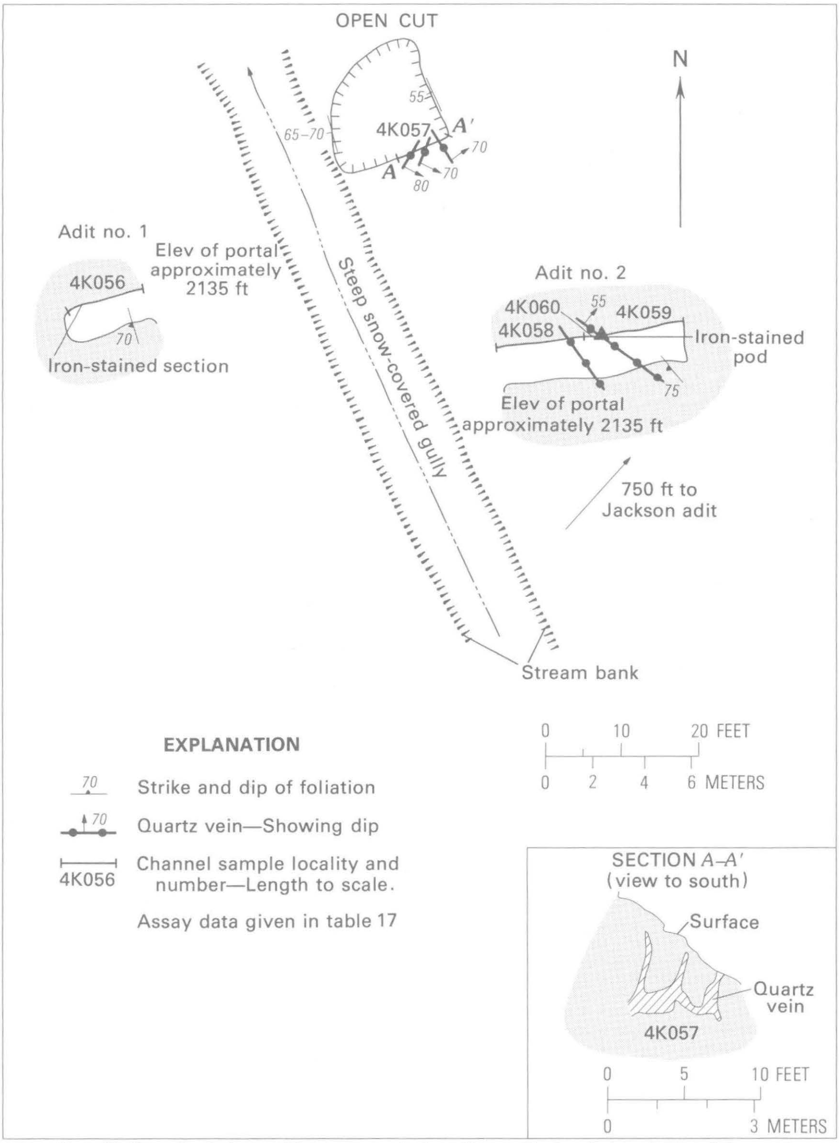

FIGURE 41.—Yellow Jacket workings, sample localities. Bedrock is schist with quartz seams and veins parallel to foliation. Mapped by A. L. Kimball and M. A. Parke, July 1974.

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.

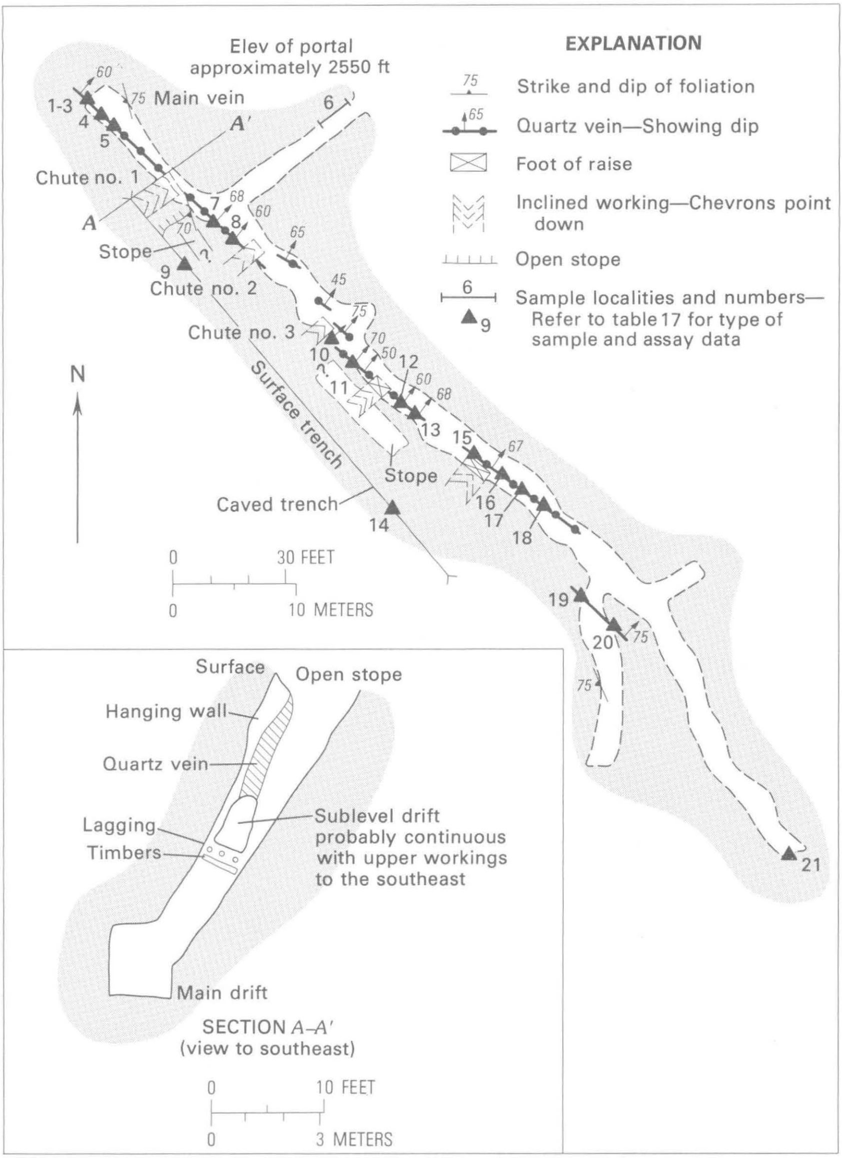

FIGURE 42.—Jensen mine, sample localities. Bedrock is muscovite schist. Mapped by A. L. Kimball and M. A. Parke, July 1974.

These zones follow the foliation of schist in the area and are marked by limonite staining. Eighteen space-chip samples were taken across the zones. Figure 43 shows the sample localities, and table 18 gives the analytical results. Four of the eighteen samples gave the following

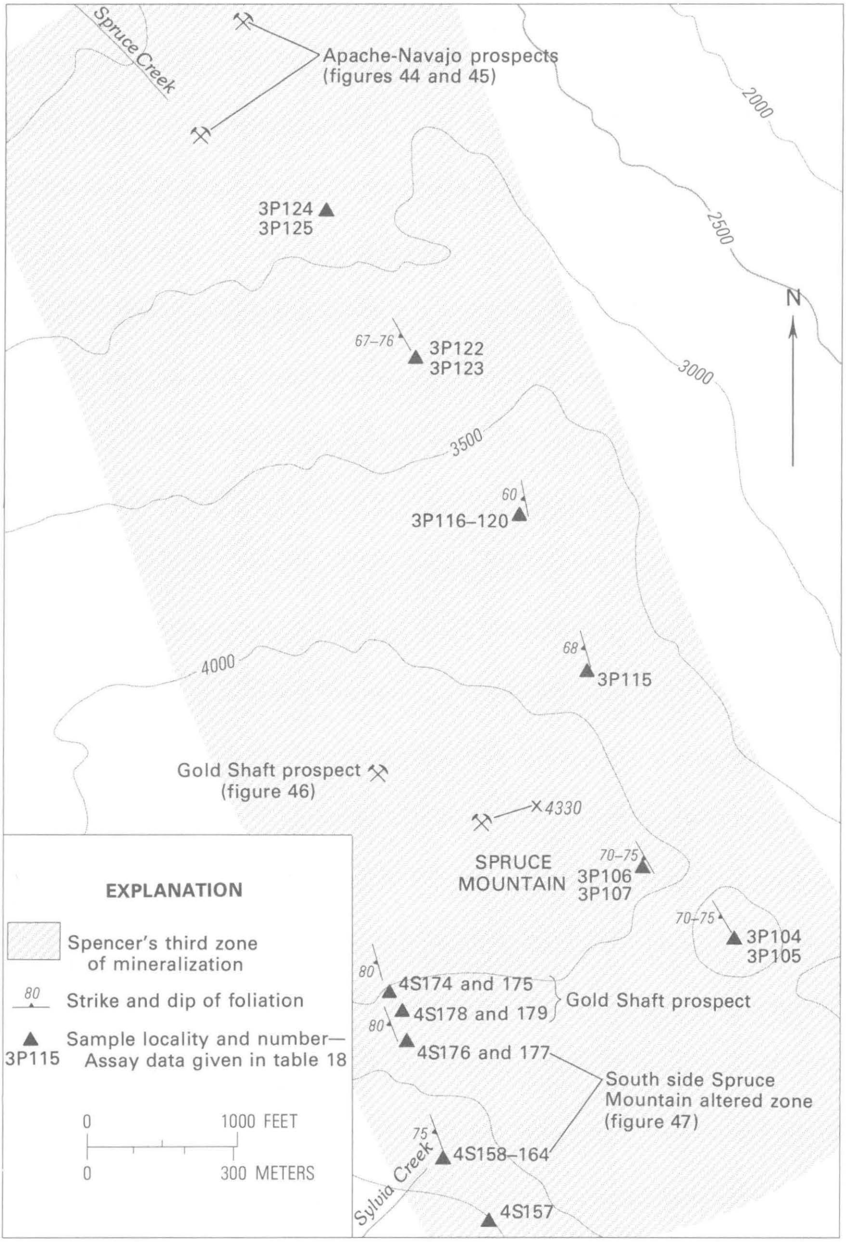

FIGURE 43.—Spencer's third zone of mineralization, prospect and sample localities. Bedrock is greenschist and greenstone or phyllite and slate. Base from U.S. Geological Survey 1:63,360, Sumdum C–4, 1961.

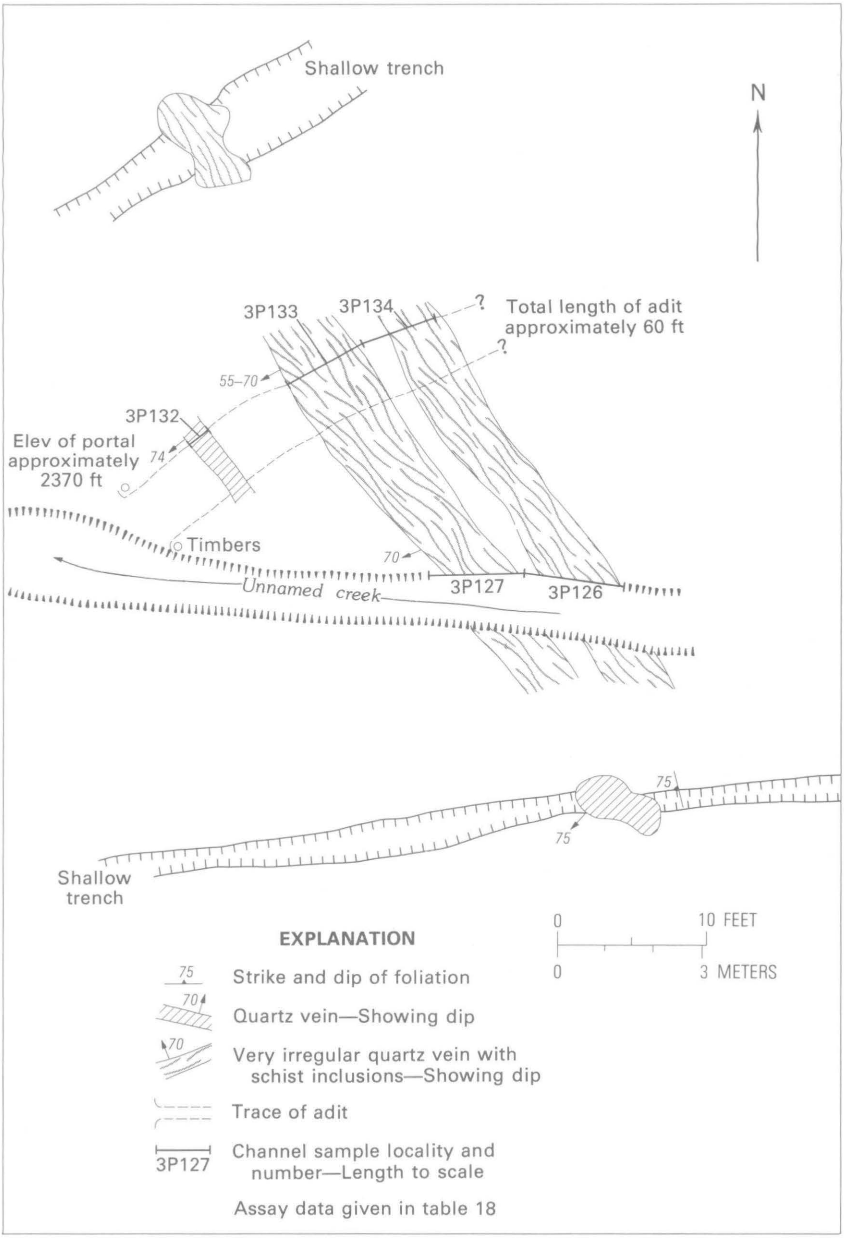

FIGURE 44.—Apache-Navajo prospect, north adit, sample localities. Bedrock is iron-stained schist with some phyllite. Mapped by T. L. Pittman and A. L. Kimball, August 1973.

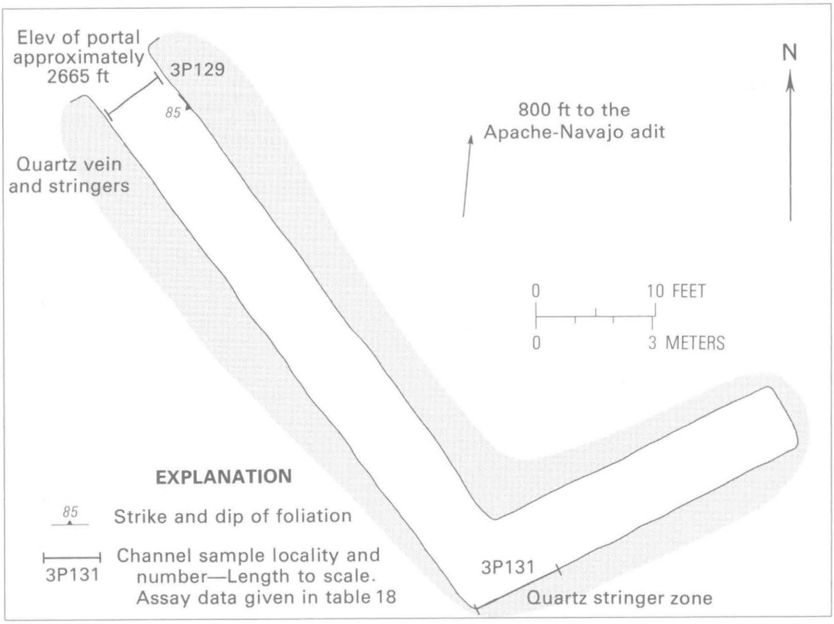

FIGURE 45.—Apache-Navajo prospect, south adit, sample localities. Bedrock is schist. Mapped by T. L. Pittman and F. R. Smith, August 1973.

results: sample 3P116, a 100-ft-long chip, contained 5 ppm silver, 1,300 ppm lead, and 7,600 ppm zinc; 3P123 17-ft-long chip, contained 3 ppm silver, 0.05 ppm gold, and 1,900 ppm zinc; 3P125, a 105-ft-long chip contained 3 ppm silver, 0.05 ppm gold, 390 ppm copper, 60 ppm lead, and 2,100 ppm zinc; and 3P107, a 50-ft-long chip, contained 2 ppm silver, 170 ppm lead and 1,000 ppm zinc. All the remaining samples were anomalous in silver, gold, lead, or zinc but in much smaller amounts than the four listed. The mineralized zones appear to extend at least 300–600 ft across the surface, much of which is inaccessible due to ruggedness of terrain and snow cover. The area may warrant exploration.

GOLD SHAFT PROSPECT

Thane (1915, p. 3) reported a 20-ft shaft and a 150-ft-long trench near the summit of Spruce Mountain on the Free Gold group of claims. Apparently there was 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-ft shaft, four small open-pits, and a 156-ft- long trench. Figure 46 shows the working and sample localities near the summit of Spruce Mountain. Of seven measured samples taken, one contained significant anomalous results: sample 3P110, a 3.8-ft channel of a quartz vein, assayed 2 ppm silver, 8 ppm gold, and 390 ppm lead. All the samples were slightly anomalous in silver at 0.5–2 ppm.

About 1,000 ft south of the summit of Spruce Mountain and within the Gold Shaft claims, a 8-ft-thick quartz vein appears from under talus at an elevation of 3,900 ft and extends to an elevation of 4,050 ft, 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-ft 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 ft 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 consists of white and yellow schist which contains 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 ft to 3,900 ft and disappears under scree at both ends. This zone is 120 ft thick at its lower end and 50 ft at its upper end. Five spaced-chip samples taken across the zone varied in length between 25 and 53 ft. Figure 47 is a sample locality map, and table 18 gives the assay returns from this zone. All samples were anomalous in silver at 0.5–10 ppm, in gold at 0.05–0.10 ppm, and in lead at 70–1,100 ppm. Two additional 2-ft-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-in.-thick vein that contains quartz, galena, chalcopyrite, and sphalerite assayed 150 ppm silver, 0.5 ppm gold, 2,100 ppm copper, 21,000 ppm lead, and 4,800 ppm zinc; however, converted to a 4-ft width the values would only be one-half of one percent of those given.

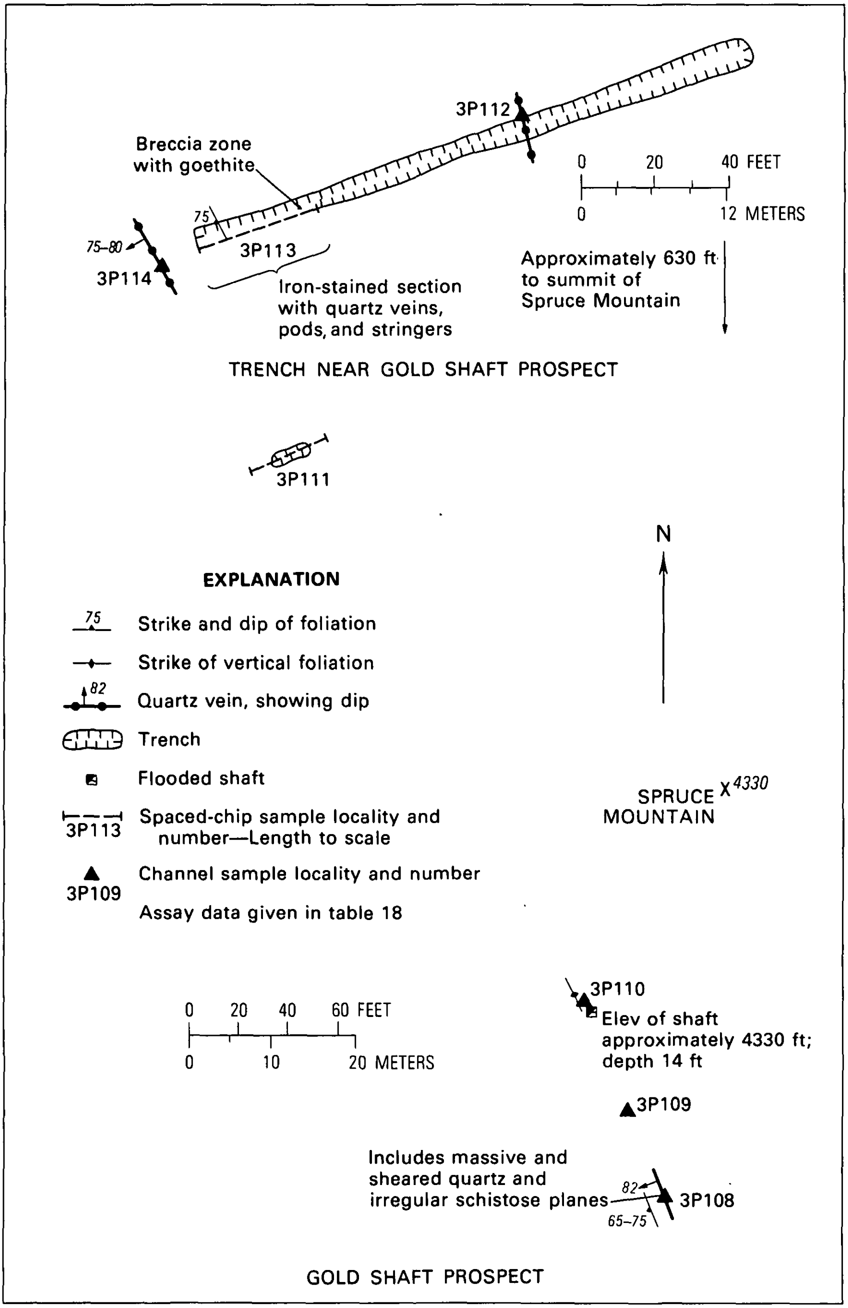

FIGURE 46.—Workings near the summit of Spruce Mountain, sample localities. Bedrock is schist. Mapped by T. L. Pittman and A. L. Kimball, August 1973.

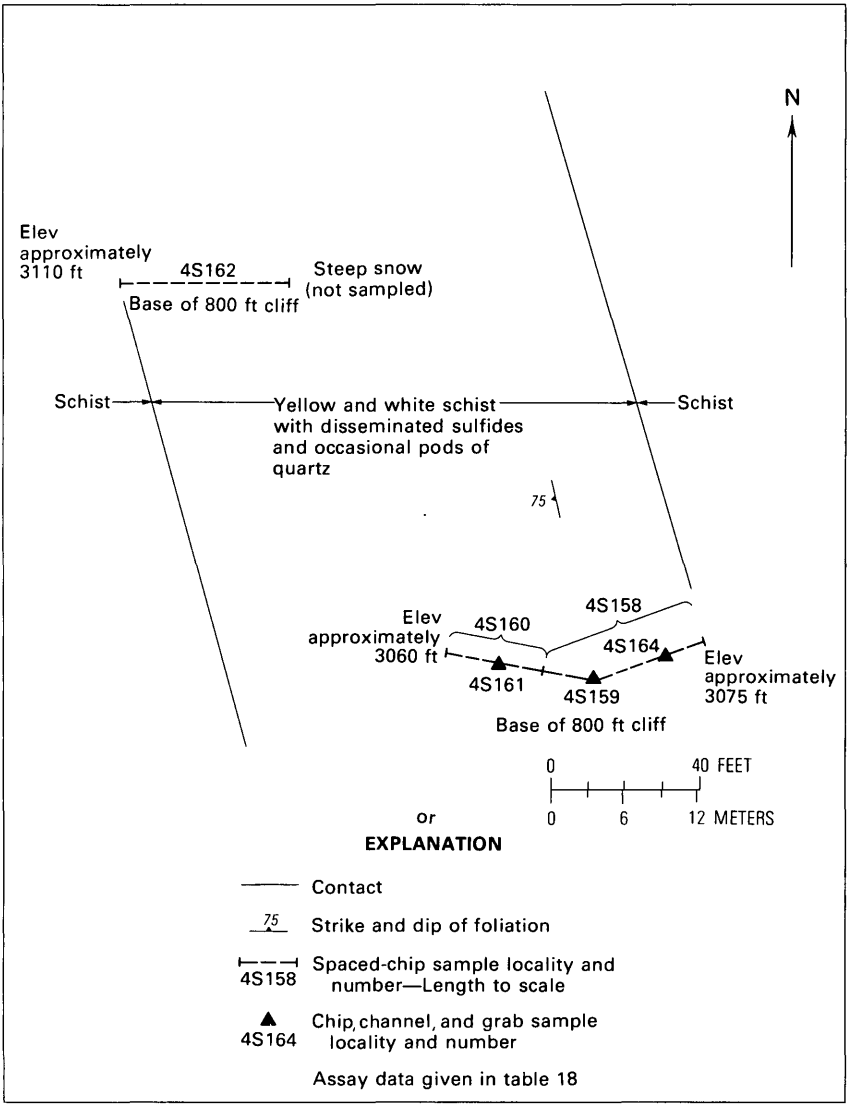

FIGURE 47.—South side of Spruce Mountain, sample localities. Mapped by J. C. Still and F. R. Smith, July 1974.

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 previously mentioned altered zone of Spruce Mountain. Although there is not enough information to locate these claims accurately (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-ft chip sample (4S149) taken across a stained zone, and a 0.3-ft 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 had 0.10 ppm gold.

CHUCK RIVER LODES

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-ft-long adit about 4,500 ft south of the mouth of the Chuck River near the base of the peninsula may be related to these claims. A 23-ft-long chip sample (4K117) taken along the length of the adit contained 0.05 ppm silver and 70 ppm lead. A 30-ft-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 localities, and table 19 gives the analytical data.

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 ft above the north side of Windham Bay about 5,000 ft east of the mouth of Taylor Creek. The Walhalla claim was staked over this red-stained cliff in 1930. A 28-ft-long space-chip sample was taken along its base. The sample (4S155) locality is shown in figure 48. The only metals of significance in the sample were 30 ppm molybdenum and 0.7 ppm silver.

ULTRAMAFIC BODY NEAR WINDHAM BAY

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-ft 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.

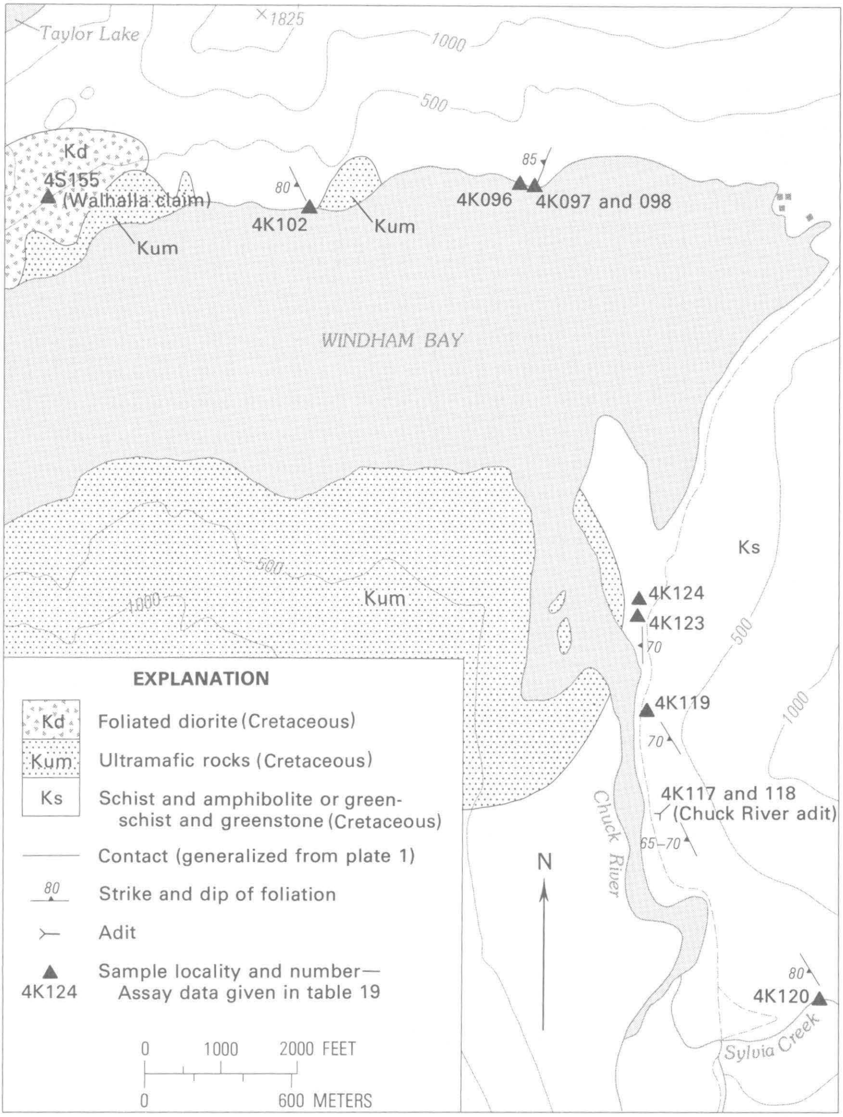

FIGURE 48.—Chuck River lode and north shore of Windham Bay, sample localities. Base from U.S. Geological Survey, 1:63,360, Sumdum C–5, 1951.

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

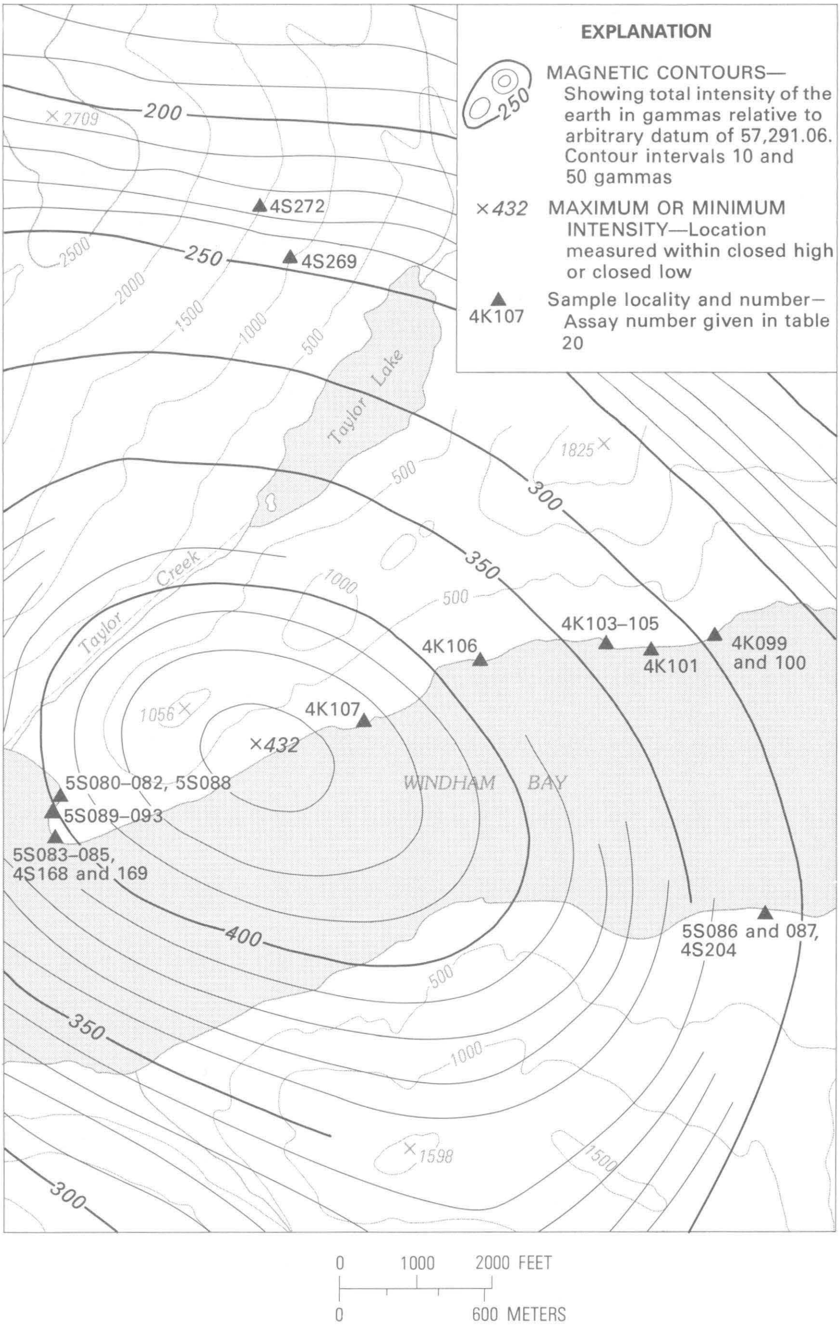

FIGURE 49.—Ultramafic body near Windham Bay, sample localities and aeromagnetic anomaly. Base from U.S. Geological Survey, 1:63,360, Sumdum C–5, 1951. Magnetic survey flown by GeoMetrics, 1973; see plate 1.

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 tails portion. Some of these samples were analyzed for silicon, iron oxide, sulfur, phosphorus, 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.

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 mi north. The iron content of the 320-ft space-chip sample taken on the north side of Windham Bay was 13.2 percent; a concentrate containing about 5.9 percent of the original sample with a grade of 53.3 percent iron can be produced by magnetic recovery. At Snettisham, a composite sample of drill holes average 18.9 percent iron; a magnetic concentrate of that sample contained 19 percent of the original sample with a grade of 64 percent iron (Thorne and Wells, 1956). The lower magnetite content of the Windham Bay sample 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 2,154 gammas). Analyses indicate no significant copper or nickel.

In general, although the Windham Bay body 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 2,000-ft 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 mi 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-ft-thick quartz vein has been explored by 240 ft of underground workings consisting of a 170-ft drift with three stope raises (figs. 50, 51). Surface pits indicate the vein is at least 400 ft long. A second vein more than 6 ft thick is well exposed for several hundred feet along strike and has been explored with several shallow shafts and open cuts. A 65-ft crosscut driven below the hill toward this vein falls several hundred feet short of intersecting the projection of the vein. Figure 50 shows the relations of these features. Wall

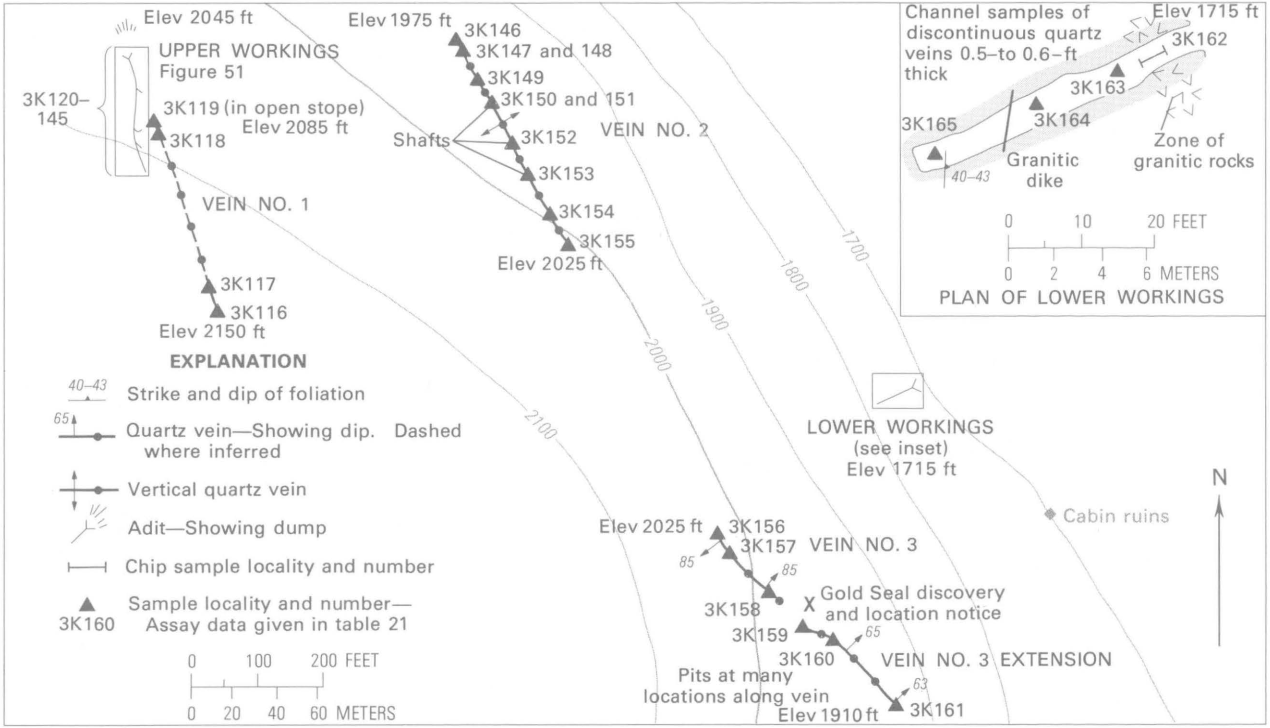

FIGURE 50.—Holkham Bay prospect, workings and sample localities. Bedrock is schist and gneiss. Mapped by T. L. Pittman and A. L. Kimball, August 1973. Inset mapped by F. R. Smith and D. D. Keill, August 1973.

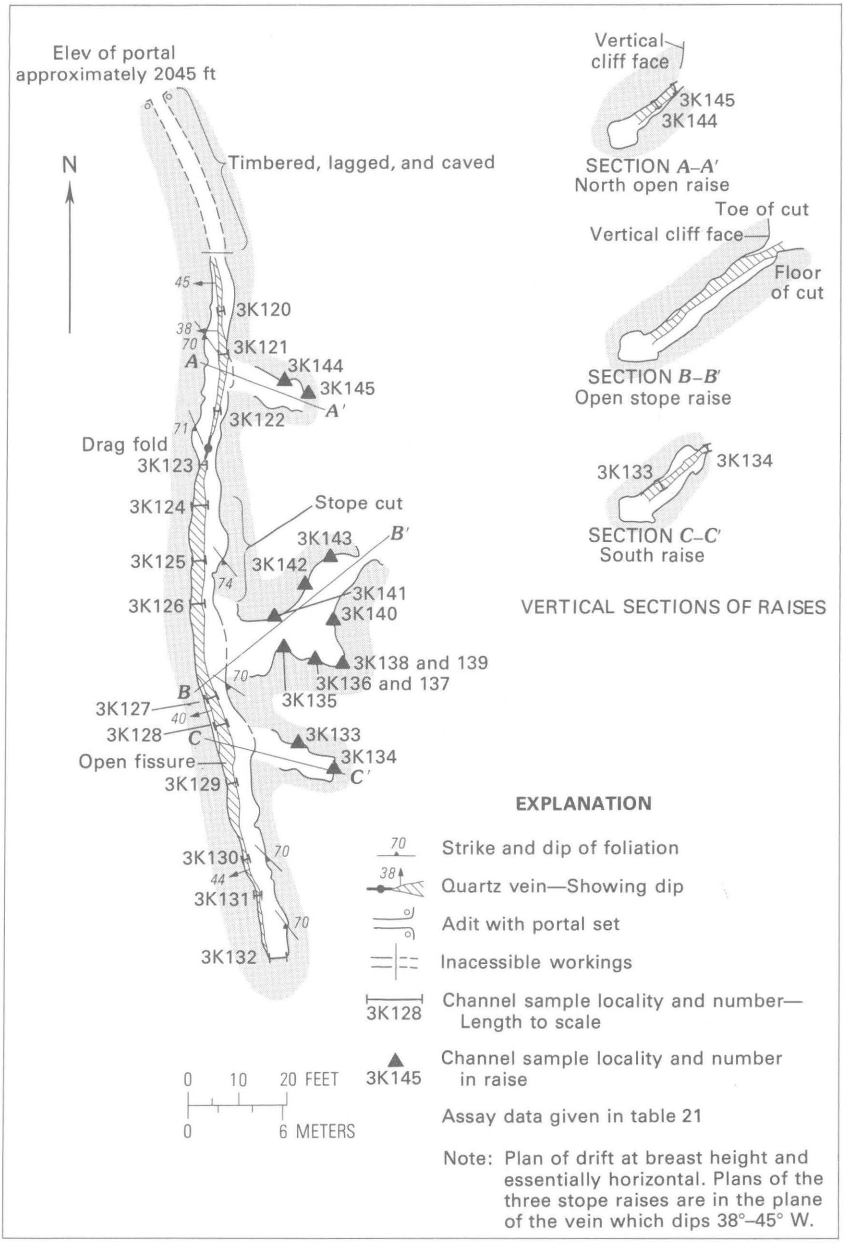

FIGURE 51.—Holkham Bay upper workings, sample localities. Bedrock is graphitic schist with traces of pyrrhotite. Mapped by T. L. Pittman and A. L. Kimball, August 1973.

rocks in the upper workings are graphitic schist 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; Brooks, 1909) indicate that much of the development described here 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 oz per ton gold across a 0.9-ft vein, values in the drift range from nil to 0.61 oz per ton gold and average 0.094 oz per ton gold. Average vein width is about 1.5 ft. 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.

The sample results show that the mined-out high-grade ore shoot probably contained 20–50 oz of gold. Further development of the mine was curtailed by lower gold values and the vein pinching out in the drift.

SPRUCE CREEK PLACERS

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

Spruce Creek, which is about 3 mi long, crosses several slightly mineralized phyllitic schist belts that 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, 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 one-quarter mile from tidewater. Mining was conducted about the same time in a second basin a mile upstream at an elevation of 750 ft. Placer claims covering both basins were patented before 1900. Other concurrent operations were also reported in smaller basins farther upstream. There has been little placer mining for the past 50 years. Operations ceased in the mid-1950'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.

The early mining removed extensive gravel 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 ft. Shallow gravel beds 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 was 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 ft below the original bedrock stream channel that crosses the barrier just south of the tunnel site. A second smaller tunnel 10 ft 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 ft below the original surface of the basins. 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 gravel slightly higher than the original stream channel; they 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; table 22). A few colors could usually be panned at these sites. Analyses performed on the minus- and plus-80-mesh fractions show that the amount of gold in the sample does not systematically correlate with one or the other of the fractions. Milligrams of gold in the total sample

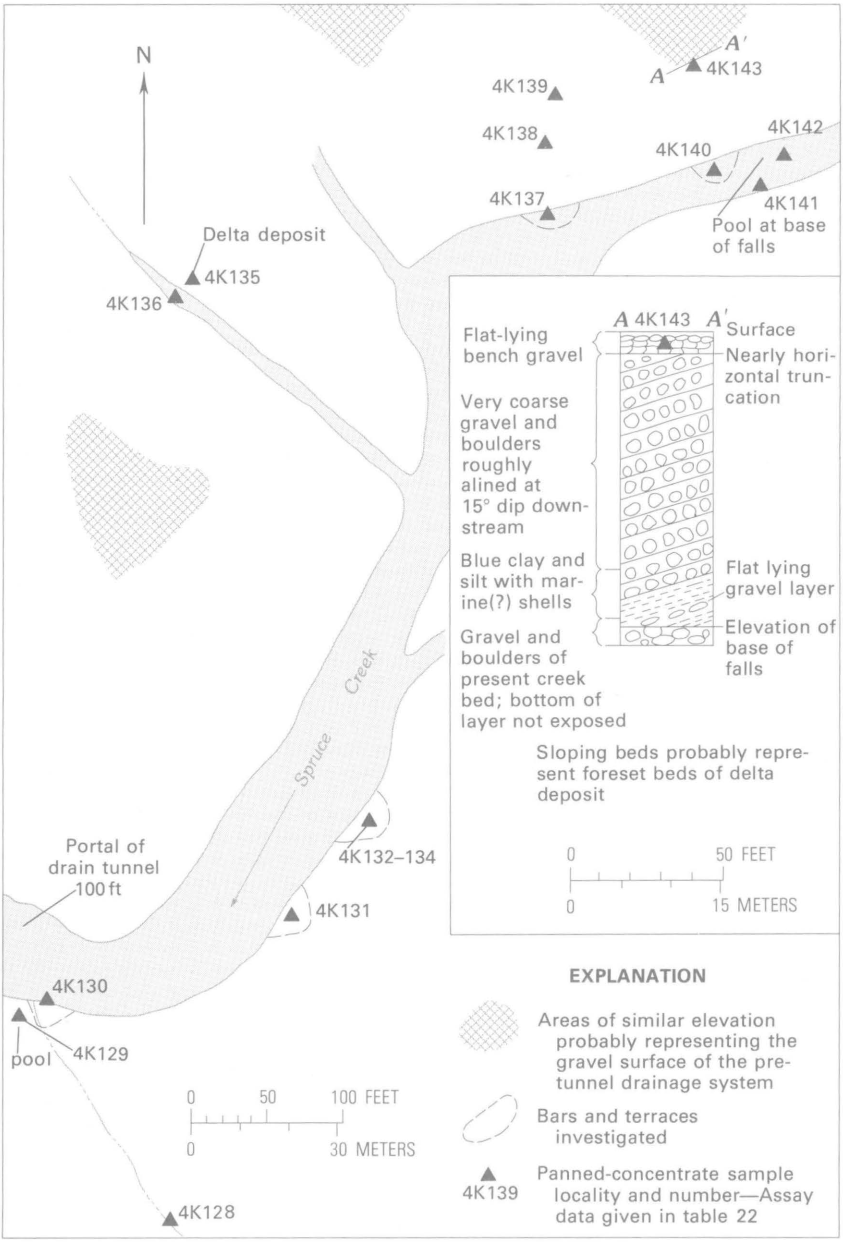

FIGURE 52.—Placer workings in the first basin of Spruce Creek, sample localities. Mapped by A. L. Kimball and M. A. Parke, July 1974.

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 ft higher than the barrier assayed 0.017 oz per cubic yard.

All other samples were from lower in the basin; seven assayed between 0.0026 and 0.001 oz 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 systemically 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.

CHUCK RIVER PLACERS

The Chuck (Shuck) River and two of its tributaries, Sylvia (Sylva) and Slate Creeks, entering the river between 1 and 4 mi above the mouth, were reported by Spencer (1906) to have been the scene of some placer activity near the turn of the century. The Chuck River proper, which is about 15 mi long and flows into Windham Bay from the south, has 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 roughly 3, 5, and 10 mi from the mouth. Spencer (1906) discussed a horseshoe bend about 8 mi above the mouth where a 300-ft diversion tunnel reportedly was driven in 1903 leaving gravel 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 mi 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 mi long, flows into the Chuck River from the west. Spencer (1906) reported 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 0.5 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 are two small glacial lakes situated in a rugged basin 6 mi southeast of Windham Bay (loc. no. M-10, pl. 3) at an elevation of about 3,300 ft. Records show that the placer claims were located near the outlet of the lake in 1898.

A proposal to drain the lakes by tunnel during the 1930's and mine placer gold from the lake-basin sediment is considered by local residents to have been a promotional scheme. At the time a 7-mi tractor trail, now largely obliterated, was constructed from the mouth of Syliva 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 oz 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 and 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 are cut by numerous small quartz stringers and veins which generally follow the foliation. Occasionally, large quartz veins more than 1 ft thick 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 operated from 1895 to 1904 and was the only mine in the study area with significant production.

SUMDUM CHIEF GOLD MINE

The Sumdum Chief gold mine, made up of two gold veins known as the Sumdum Chief and the Bald Eagle, is located about 2 mi 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 shows the claim locations. According to Spencer (1906, p. 44), two lodes were mined from a 3,500-ft haulage drift. The Bald Eagle lode was intersected at a depth of 500 ft where it was 20 ft wide and carried 0.5–0.10 oz per ton gold. On the surface, this lode was 2 ft wide and assayed 0.48 to 0.73 oz per ton gold. The Sumdum Chief lode was intersected at a depth of 1,200 ft where it was only a narrow vein filling. On the surface, this lode was 3 ft wide. Between 1895 and 1903, approximately 24,000 oz 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 oz per ton gold.

According to Roppel (1971), a 1,600-ft raise was driven from the end of the 3,500-ft haulage drift. The first part of the raise intersected ore, then only barren rock. By 1903, both ore bodies were stoped

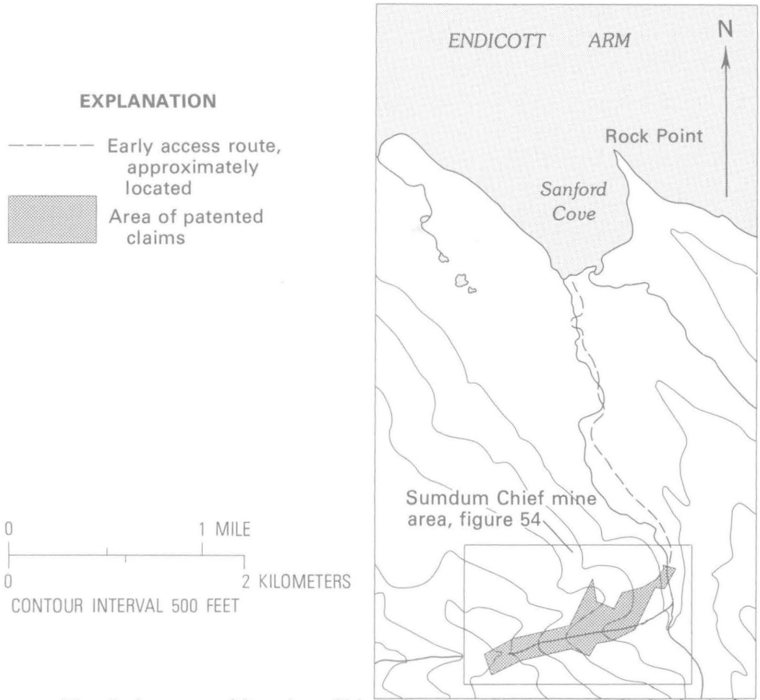

FIGURE 53.—Index map of Sumdum Chief mine area. Base from U.S. Geological Survey, 1:63,360, Sumdum C-5, 1951.

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 in 1907 when an attempt was made to reopen 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 ft. 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 ft. The Bald Eagle vein, which reportedly was exposed at an elevation of about 1,000 ft in Bald Eagle Creek, was not seen and was probably covered with slide snow or rubble. Figure 54 shows 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.

The only accessible mine working is a stope on the Sumdum Chief

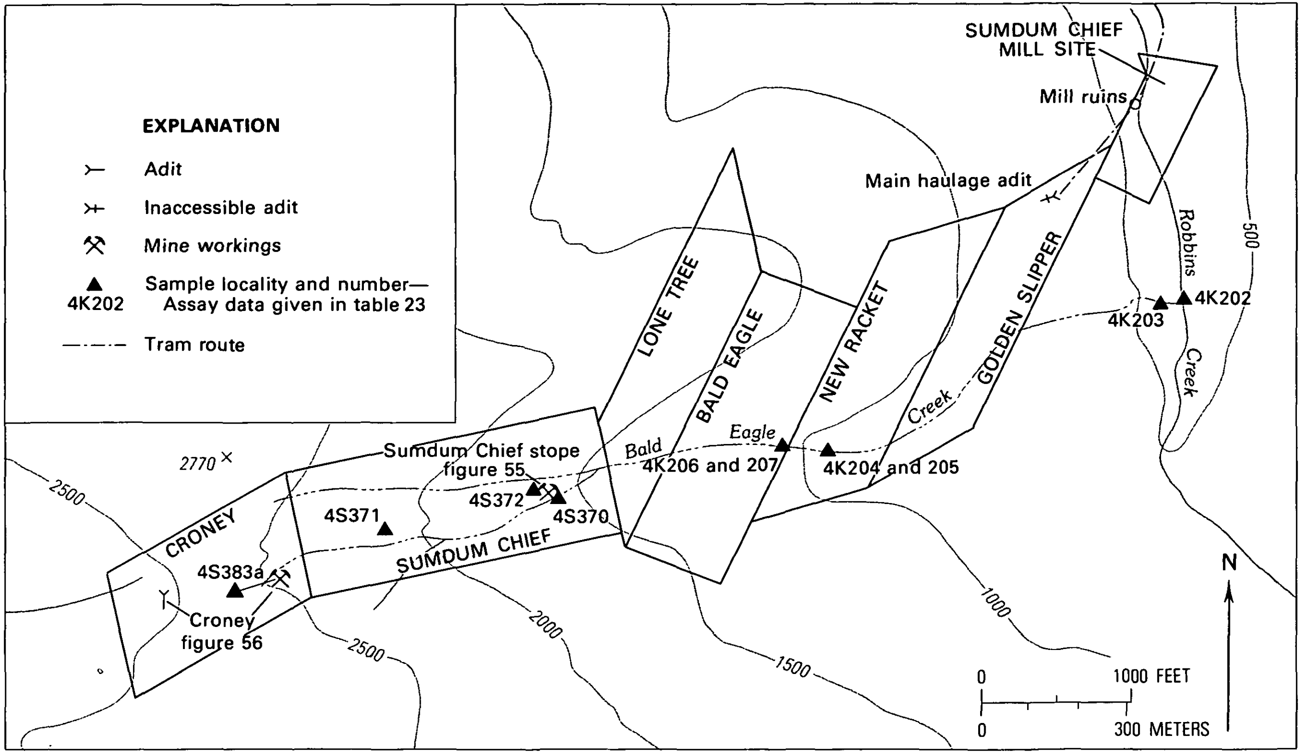

FIGURE 54.—Sumdum Chief mine area, sample localities, mine workings, and patented claims. Bedrock is graphitic limestone or greenschist and greenstone or phyllite and slate. Base from U.S. Geological Survey 1:63,360, Sumdum C–5, 1951. Location of claims from Mineral Survey plats number 267A, 268A, 269–70, 424, and 525A–D, 1900. Creek names are from Mineral Survey plats and are unofficial.

vein. The opening is located on a precipitous, cleaver-shaped ridge 900 ft below a natural helicopter landing site in the 2,500-ft 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. and inclined 84° to the north, is the same as the attitude of the 1-ft-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-ft-long chip sample (4S365) across what is probably the upper part of the Sumdum Chief vein assayed 30.2 ppm (0.88 oz per ton) silver, 26.1 ppm (0.76 oz per ton) gold, 940 ppm copper, 1,900 ppm lead, and 3,100 ppm zinc (table 23). The gross value of this sample in gold and silver for a 4-ft mining width is about $26 per ton ($130 per oz gold and $4.50 per oz silver at 1976 prices). A 0.4-ft 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, one contained 0.10 ppm and one 0.40 ppm gold, and all four contained 1–2 ppm silver. A stream-sediment sample taken in Robbins Creek above Bald Eagle Creek contained 1 ppm silver.

Spencer (1906, p. 44), Brooks, (1905, p. 53), and Roppel (1971, p. 50) indicated 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 ft wide, contained only 0.05–0.10 oz per ton gold. An attempt was made to mine the Bald Eagle lode below the haulage level by underhand stoping but it proved uneconomical

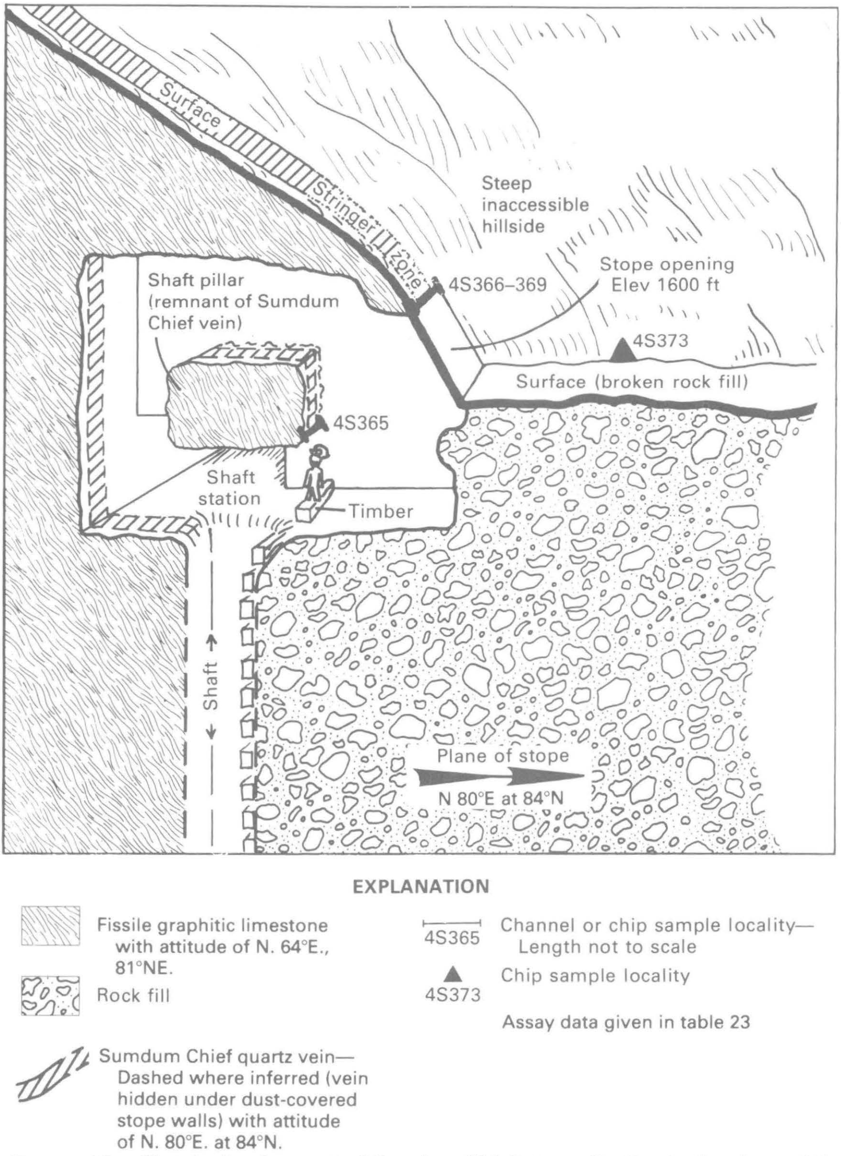

FIGURE 55.—Sketch showing part of Sumdum Chief stope. Section in the plane of the stope with south wall removed to show underground workings. Human figure for scale. Mapped by J. C. Still and M. A. Parke, August 1974.

(Spencer, 1906, p. 44). No mention is made in the literature about the horizontal extent of these two lodes. Bureau of Mines sampling in the area failed to reveal any new gold-silver veins. No mine maps, assays, or detail 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 mi 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 part 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 ft in elevation and a 27-ft adit on the west side of the pass. Figure 54 shows the location of the claim and figure 56 shows details of the adit and open cut; table 23 gives the assay results. The samples were taken of stringer zones of quartz that follow the structure of the fissile graphitic limestone, which strikes N. 83° E. and dips 78° N. A very noticable aspect of the structure of this prospect is the

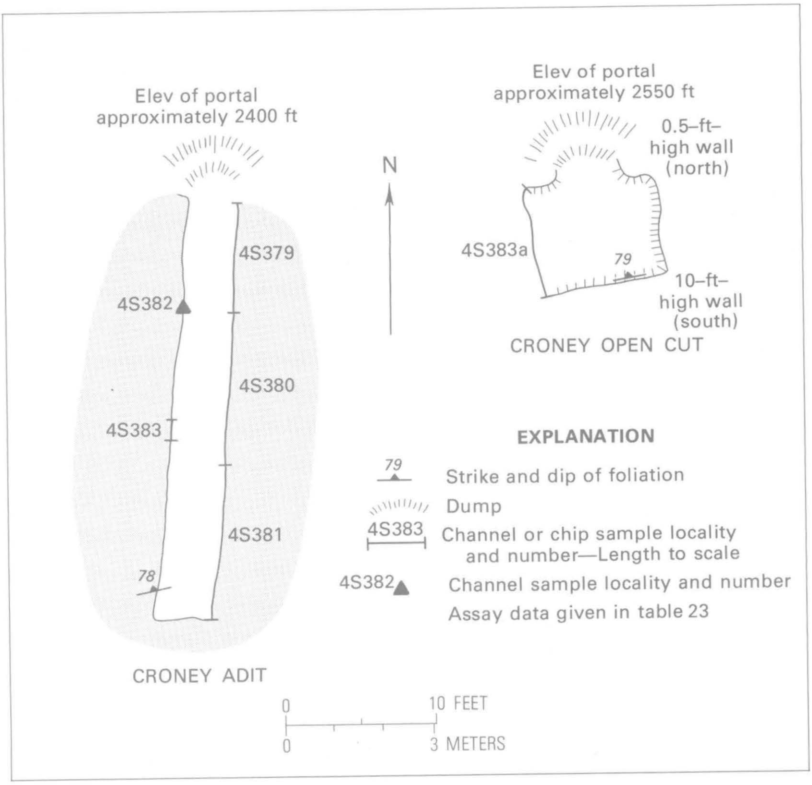

FIGURE 56.—Croney adit and open cut, sample localities. Bedrock is fissile graphitic limestone with quartz stringers zones. Mapped by M. A. Parke, August 1974.

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 range from 1 to 3 ppm in all the samples.

TAYLOR LAKE AREA

Taylor Lake is located at the head of 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 39 lode claims were staked in the area about 1900. The only mention of this area in the 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, mostly 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, and east 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 one-eighth mile from the northeast end of the lake. Figure 57 shows sample and prospect locations.

The most significant sample values were found in a 1.5- to 1.6-ft-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 interst. However, the mineralogy and host rock are similar to the Sumdum Chief mine located 4 mi to the northwest, and further exploration of this vein and in the area reveal higher values and more gold-silver veins. The next most significant value was from a 2- to 3-ft-thick quartz vein located at an elevation of 1,300 ft 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.

BLUEBIRD PROSPECT

The Bluebird claim was located 600 ft east of the north end of Taylor Lake in 1903, according to Juneau precinct mining records, on a quartz vein approximately 2 ft thick exposed in a small stream. There is

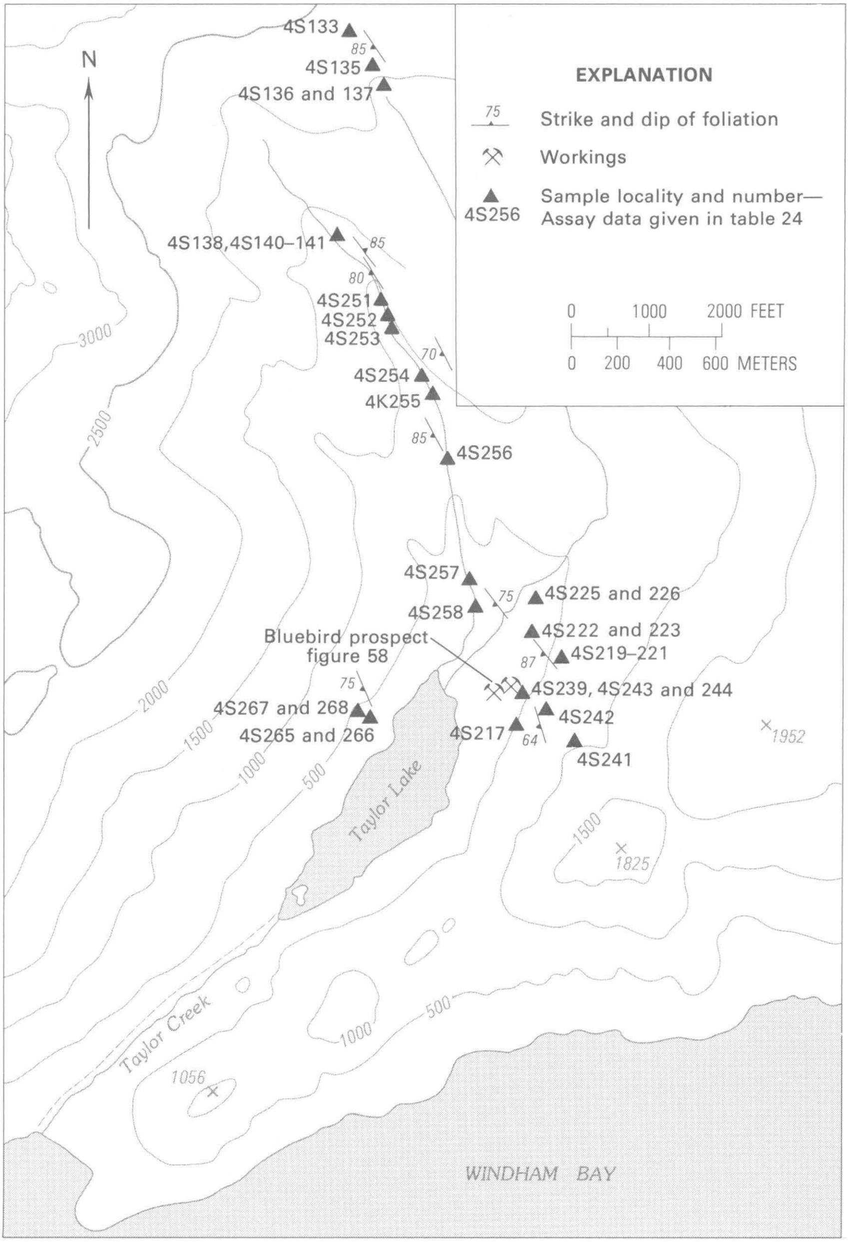

FIGURE 57.—Taylor Lake area, prospect and sample localities. Bedrock is mostly hornblende schist and amphibolite or greenschist and greenstone or calcareous graphitic schist. Base from U.S. Geological Survey, 1:63,360, Sumdum C–5, 1951.

no additional information on this claim, although the nearby Jack Pot claim was briefly mentioned by Spencer (1906, p. 40).

There are two workings on the Bluebird claims; a 5- by 5-ft open cut on the south bank of a stream and a flooded shaft about 180 ft east-southeast of the open cut. Figure 58 shows the relationship of the workings and the sample locations. The open cut exposes a 1.6-ft-thick quartz vein that is exposed in the stream below it but not elsewhere. The vein strikes N. 40° W. and dips 71° SW., while the calcareous graphitic schist country rock of the phyllite and slate map unit strikes N. 22° W. and dips vertically. Abundant pyrite, sphalerite, chalcopyrite, and galena are found in the hanging wall of the vein.

The 6-ft-square shaft is flooded at a depth of 8 ft below the collar. The size of the dump indicates there is some 400 ft of underground workings. The only significant exposure of mineralized rock in the vicinity is the 1.6-ft-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 ft and thus permit 275 ft of drifting on the vein. The rocks on the dump consist

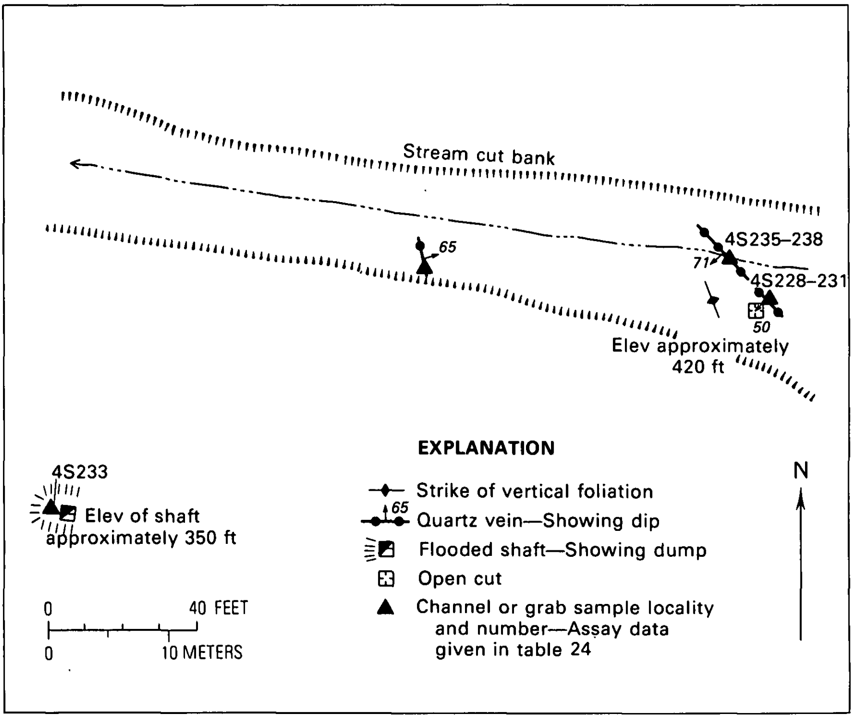

FIGURE 58.—Bluebird prospect, sample localities. Bedrock is calcareous graphitic schist.

of about 50 percent quartz with a texture of sulfide mineralogy similar to that of the open cut vein. A complete stream-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 analytical results. A 1.5-ft channel sample (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, and a 0.3-ft channel sample (4S229) cut along the hanging wall of the vein exposed in the open cut assayed 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-ft-long footwall (4S230) part of the open cut vein contained no significant metal values. A selection of high-sulfide quartz fragments taken across the shaft dump (4S233) assayed 3 ppm silver, 400 ppm copper, 840 ppm lead, and 2,800 ppm zinc; gold was detected but was below the measurable limit. Similarity in geologic setting between the Sumdum Chief gold mine and Bluebird prospect indicates that the 4-mi area between them is favorable for vein-type gold deposits.

QUARTZ VEIN AT 1,300-FT ELEVATION

A 2- to 3-ft-thick quartz vein is exposed high on a cliff at an elevation of about 1,300 ft on the east bank of a stream that flows into the north end of Taylor Lake. This vein appears to crosscut 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 and 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 rock is discussed on p. 196). Figure 57 shows the sample localities. Of 30 samples taken in the area, a few were slightly anomalous. Eleven contained 0.5–1.5 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 largest number of significant metallic mineral resource occurrences in the study area. It is adjacent to the Coast plutonic complex sill. The belt extends from Sweetheart Lake at the north end to the Holkham Bay prospect and probably beyond at the south end, and its width ranges from 0.6 to 1.2 mi. The total known length within the area studied is 32 mi. The Sumdum Chief gold mine is to the west of the belt. There are 12 specific mineralized areas. The following discussion of the 12 areas starts at the north end.

LOWER SWEETHEART LAKE TO TRACY ARM ELBOW

A prominent, partly iron stained linear depression one-fourth mile west of the tonalite contact that marks the east margin of the Sumdum Glacier mineral belt extends from Lower Sweetheart Lake and through a 3,000-ft saddle to the elbow of Tracy Arm. It is alined 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).

Spencer (1904) referred to a galena prospect named the Cook group and reported (Spencer, 1906) a gold-quartz prospect carrying considerable galena, and he showed it northwest of Lower Sweetheart Lake near its outlet. Mining records before 1907 list three claims near the lake, two on the south side and one near the outlet, all were 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 are shown in figure 59. Five stream-sediment samples from a north shore drainage in schist near the diorite contact were slightly anomalous in lead; two of these contained 0.5 and 0.1 ppm gold. Stream-sediment samples 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.

Mining records indicate that several claims have been located in

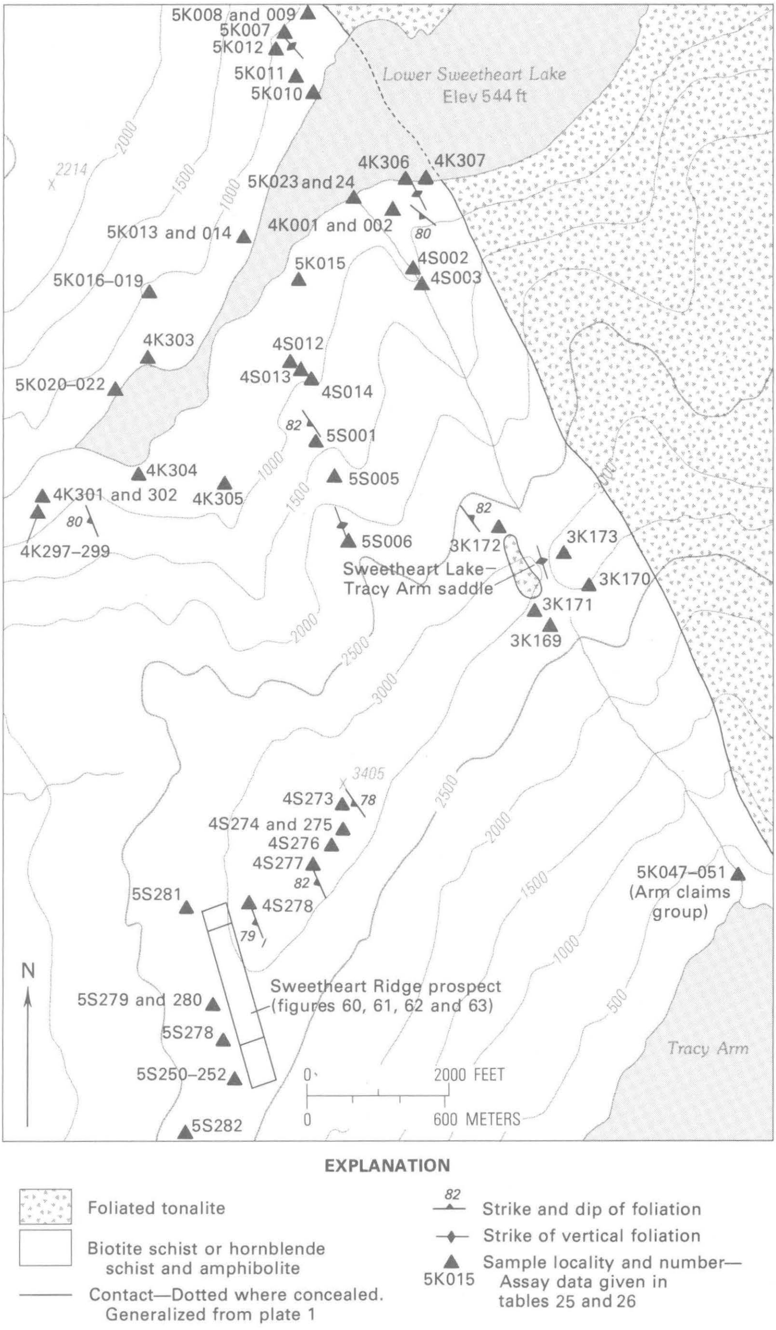

FIGURE 59.—Lower Sweetheart Lake to Tracy Arm area, prospect and sample localities. Base from U.S. Geological Survey, 1:63,360, Sumdum D-5, 1955.

the general area of the 3,000-ft saddle that 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 30-ft-thick brecciated pyritic quartz vein has been explored with a short open cut in this area 300 ft below the saddle. The vein, which strikes N. 30° E. and dips steeply northwest, is not exposed elsewhere. Analysis of a chip sample (3K169) of the vein showed small quantities of lead, arsenic, gold, and silver (table 25), although a later fire assay did not indicate gold or silver.

Boulders of sulfide-bearing quartz float were found on the mountainside 200 ft above the breccia vein. The source could not be found, although the size of the float indicates that the vein is at least 2 ft thick. Selected material from the float (3K171) contained arsenic, lead, a little gold, and a trace of silver, but it 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 ft 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 float contains visible, sparsely disseminated pyrrhotite and microscopic traces of chalcopyrite. This depression generally alines with the Tracy Arm zinc-copper prospect to the south.

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 described in the previous section. Gold values are up to 0.557 oz per ton across a 6-ft width, and copper values are up to 1.1 percent for a 4-ft 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 ft and crosses the ridge between Tracy Arm and Lower Sweetheart Lake at an elevation of 2,900 ft. This ridge forms the boundary of the Tracy Arm–Fords Terror wilderness study area. (This zone is located in the northwest-striking steeply dipping chlorite, phyllite, and schist, hornblende schist, and gneiss of the hornblende schist and amphibolite map units.) Figure 59 shows the location of the zone relative to Tracy Arm, and figures 60, 61, and 62 show the area mapped 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 and led to a more comprehensive examination in 1975. Access to this prospect was gained by a helicopter flight to a natural landing site in the vicinity. The area could also be reached on foot with some difficulty from Tracy Arm, Williams Cove, or Gilbert Bay.

A structural depression apparently caused by differential weathering of chlorite schist separates the eastern and western parts of the altered zone. 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

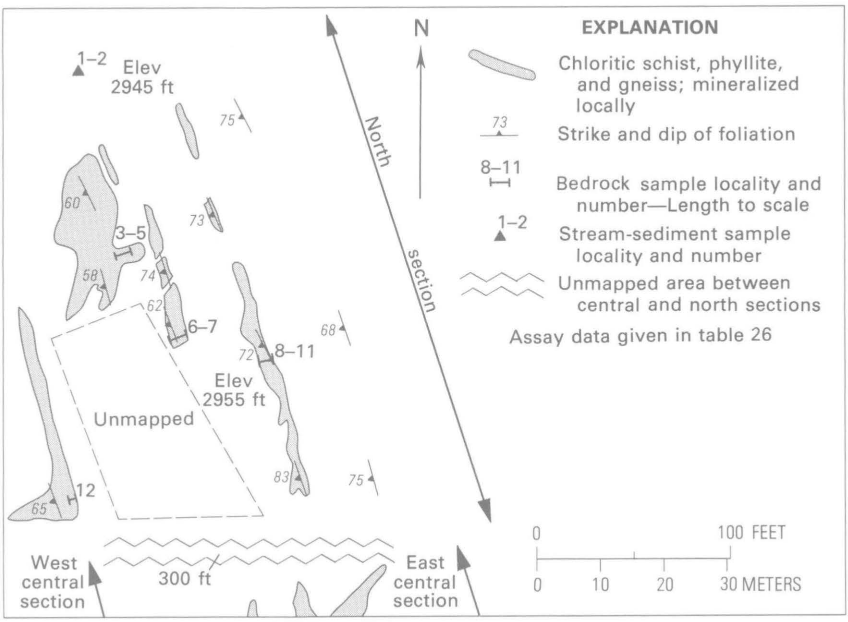

FIGURE 60.—Sweetheart Ridge prospect, north section, sample localities. Mapped by J. C. Still, W. L. Gnagy, K. R. Weir, and J. L. Rataj, September 1975.

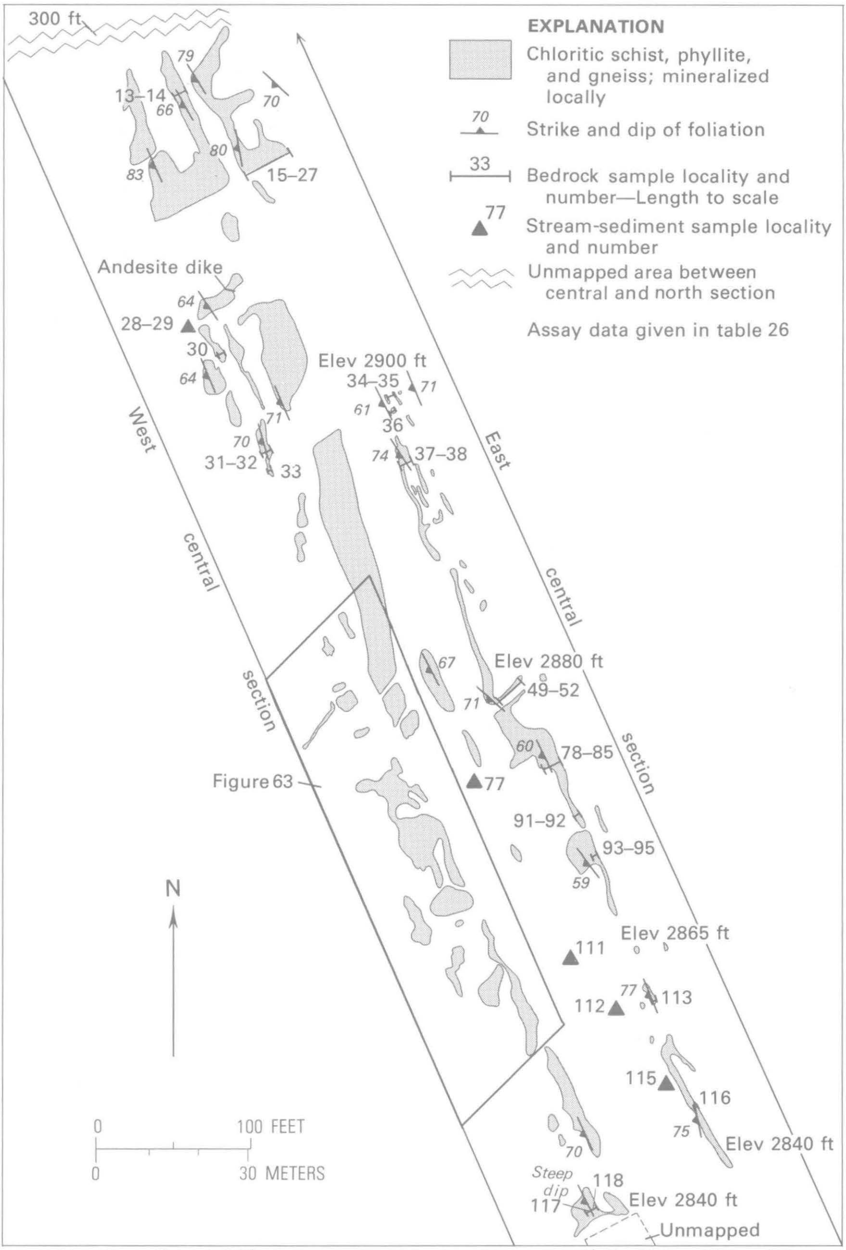

FIGURE 61.—Sweetheart Ridge prospect, central section, sample localities. Mapped by J. C. Still, W. L. Gnagy, K. R. Weir, and J. L. Rataj, September 1975.

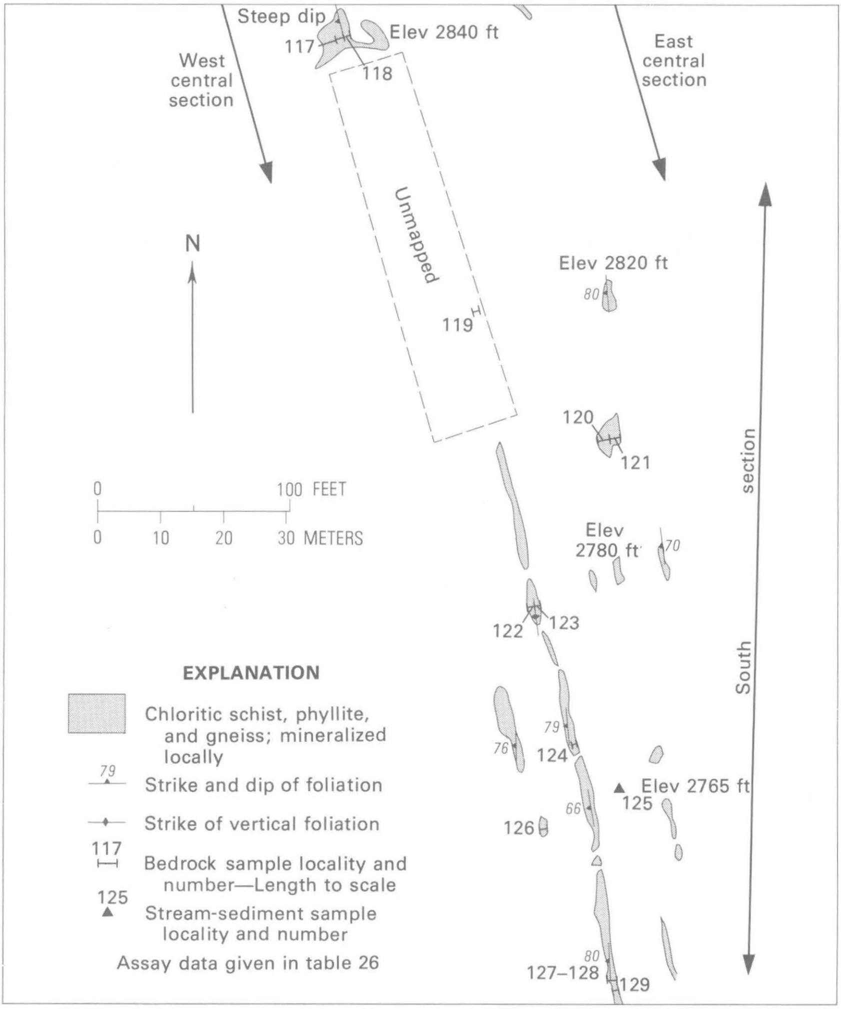

FIGURE 62.—Sweetheart Ridge prospect, south section, sample localities. Mapped by J. C. Still, W. L. Gnagy, K. R. Weir, and J. L. Rataj, September 1975.

from Tracy Arm to Sweetheart Lake, a horizontal distance of 5.5 mi over an elevation change of 3,000 ft.

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, epidote, and traces of goethite and hornblende. The sulfides are both disseminated and in thin layers and consist largely of chalcopyrite, pyrite, occasional sphalerite, and rarely galena. Disseminated pyrite and chalcopyrite are concentrated in layers within the zone that alines with the foliation. Layers containing chalcopyrite are found throughout the zone. Figures 60 through 62 are maps showing outcrop and sample localities in the 2,000-ft-long area examined. Table 26 gives the assay results.

The most important mineralized band thus far discovered is located in the west-central section and consists of cataclastic quartz-rich gneiss 5–6 ft thick capped by intense orange-red iron stain. Figure 63 is a map of the geology and sample localities for this section, which is referred to here as the Sweetheart Ridge prospect. Petrographic examination did not reveal secondary sulfide enrichment or residual gold concentrations associated with the capping. Sampling reveals that a 147-ft strike length of the stained gneiss contained the most significant values in gold. Channel and chip samples, 5–6 ft long, had values ranging from 0.114 to 0.577 oz per ton gold, 0.01 to 0.65 oz per ton silver, and 0.21 to 0.93 percent copper for the 147-ft-long best section. A rough determination of the average width, tonnage, and grade of the exposed part of the 147-ft zone section (made by considering the influence of each sample to extend halfway to adjacent samples, both within the zone and at the ends) is that there are about 7,300 tons per 100 ft of depth with an average width of 5.5 ft an average grade of 0.23 oz per ton gold, 0.31 oz per ton silver, and 0.7 percent copper for this best section. The location of this section is shown in figure 63.

Intermittent outcrops aline with the strike of the gold-rich gneiss for 50 ft past the north end of the 147-ft 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 samples 42 and 43 (fig. 63) taken in a pit that alines with the strike of the gold-rich gneiss. Trenching through thin soil cover will be necessary to determine its northern extent. Examination of outcrops and sample results indicate the gold-rich gneiss does not continue to the south in the area exposed by outcrops.

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

The reminder of the altered zone (excluding the gold-rich gneiss) consistently contained up to 0.9 ppm gold, up to 20.9 ppm silver, and up to 2 percent copper. 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.

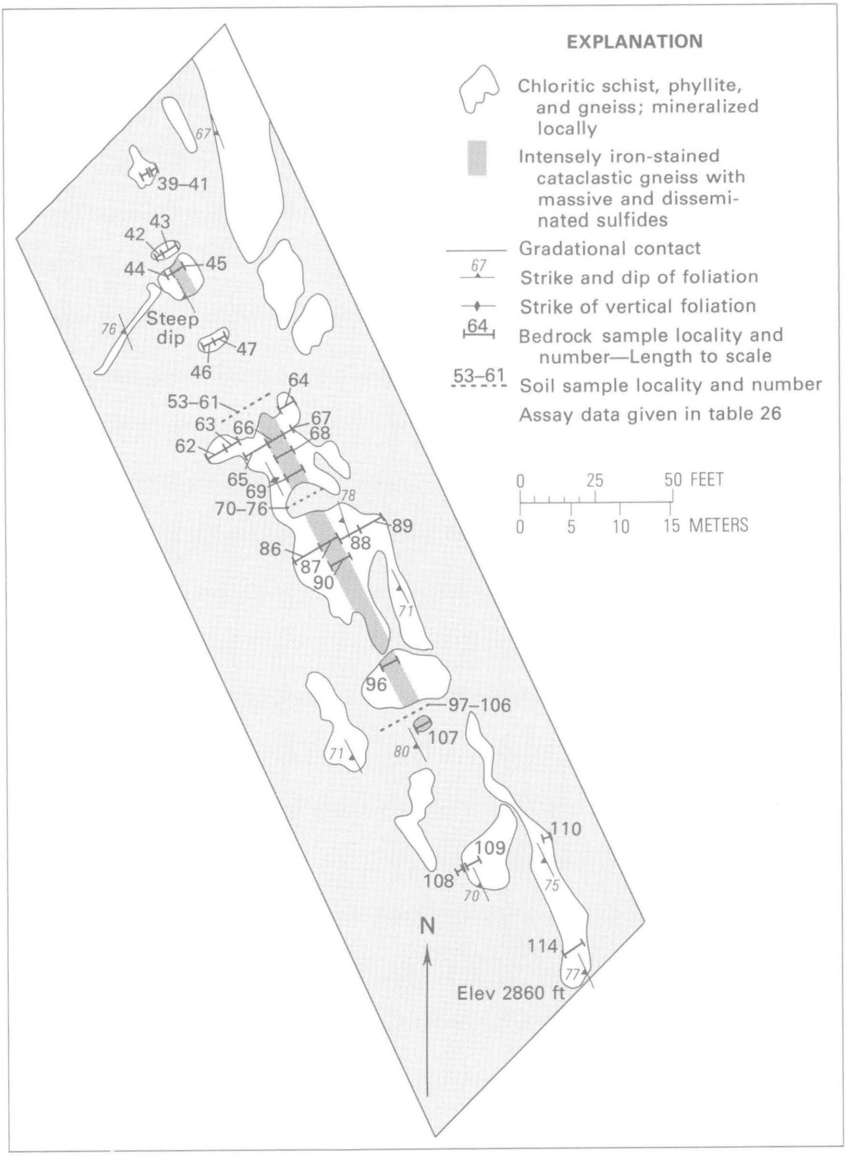

FIGURE 63.—Sweetheart Ridge prospect, west-central section detail, sample localities. Mapped by J. C. Still, W. L. Gnagy, K. R. Weir, and J. L. Rataj, September 1975.

Although most of the 2,000-ft mapped part 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-ft-long traceable mineralization, widths up to 6 ft, and grades ranging up to 0.5 oz per ton gold, 1.1 percent copper, and some silver and zinc.

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 localities, and 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 ft west of the Sweetheart Ridge mineralized zone and parallel to it. Eight samples (samples 5S250–252, 5S278–281, in fig. 69) of the more promising outcrops distributed 2,500 ft along strike were taken along this zone. The samples were chip or spaced-chip samples from 3.3 to 13 ft 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 ft 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 (5S102–104) from one zone of stained gneiss with disseminated pyrite contained up to 940 ppm zinc. This zone is roughly alined with the main mineralized zone, but a long distance to the south. Chip samples (5S106–109) from another zone of stained gneiss with disseminated pyrite contained a trace of gold and up to 200 ppm zinc.

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 mi northwest of Mount Sumdum on a bench about one-fourth mile east of shoreline (pl. 3; figs. 64, 65). Banded pyrrhotite, sphalerite, and chalcopyrite in a well-defined zone parallel the foliation in

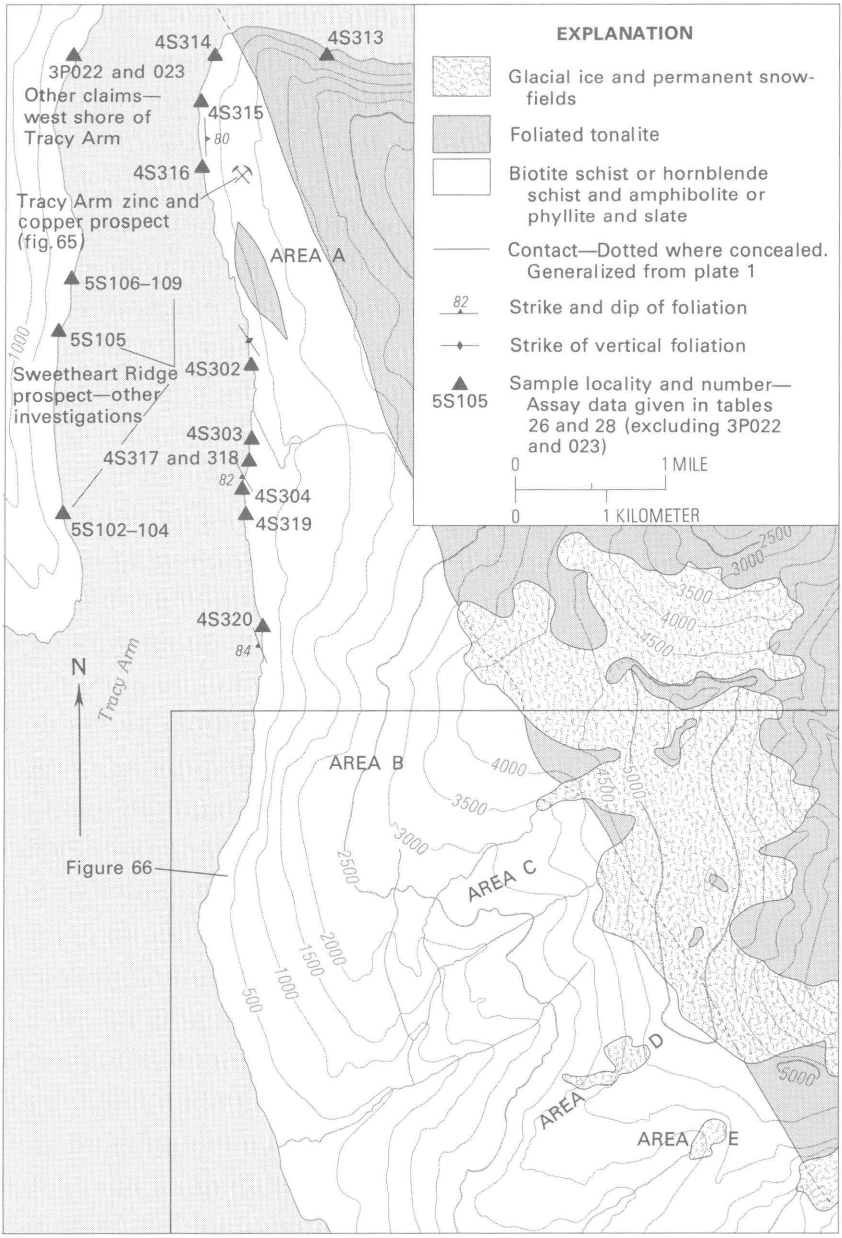

FIGURE 64.—Sumdum Glacier mineral belt between Sumdum copper-zinc prospect and Tracy Arm. Lettered sample areas refer to table 28. Base from U.S. Geological Survey 1:63,360, Sumdum D–5, 1955.

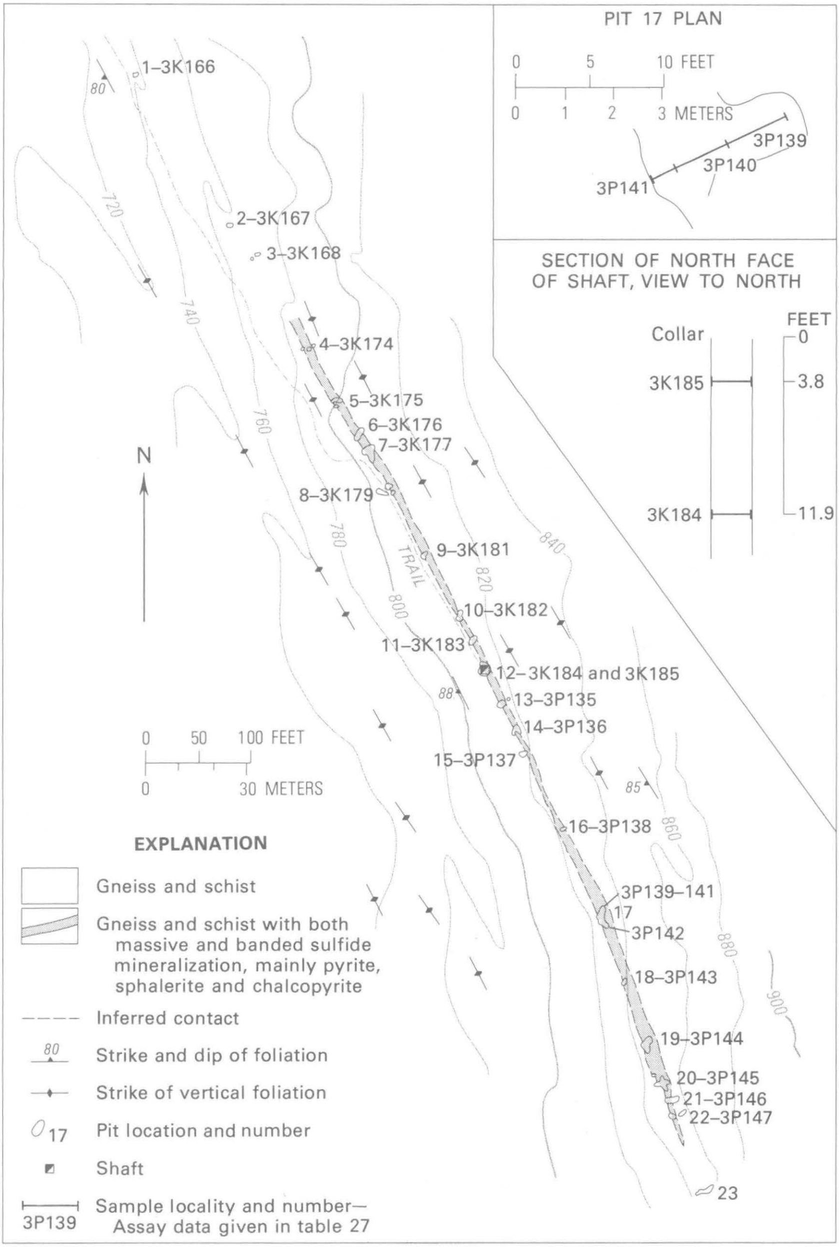

FIGURE 65.—Tracy Arm zinc-copper prospect, sample localities. Base from U.S. Geological Survey (Gault and Fellows, 1953) modification of Inernational Boundary Survey maps and of Coast and Geodetic Survey charts.

hornblende-plagioclase to hornblende-biotite gneiss. The zone is exposed in 22 shallow open cuts and a 16-ft shaft. The open cuts are distributed along strike for 1,150 ft and range in elevation from 740 to 850 ft. The width of the zone ranges from 1 to 10 ft. The mineralization strikes N. 20°-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 in. 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-ft shaft along a strike length of 500 ft 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 No. 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 configuration 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 (1925), by Roehm (1942), and the Bureau of Mines in 1943. Reed and Twenhofel (1943) also briefly examined the prospect in 1943, and their recommendation resulted in detail work by Gault and Fellows (1953) in 1944 under the strategic minerals program.

During the present study, access to the prospect was gained on foot from a cleared helicopter landing site about 1,500 ft north of the shaft on the mineralized zone. In addition, an old but usable trail about a mile long leads 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 ft 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 pyrrhotite, sphalerite, and chalcopyrite from 0.5 to 3.5 ft thick is exposed in nearly all of 18 cuts along the more heavily mineralized 850-ft section of the zone.

A 300-ft section of the 1,100 ft 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 oz per ton silver and 0.008 oz per ton gold across a 5.2-ft 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 the strike for 850 ft and down dip for 425 ft, approximately

187,000 tons are inferred if a 10 ft^3 per ton volume-weight ratio is used.

Magnetometer reconnaissance during the present study indicate 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.

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.

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 conspicuously stained red and yellow. Those zones as much as 0.4 mi wide, follow outcrop foliation and can be traced for miles. 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 goethite 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 to 180 ft. Figures 64 and 66 show the area and sample localities, and table 28 gives 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 samples contained 0.5–1 ppm silver. Two samples contained significant mineralization: one, an 0.8-ft channel sample (4S364) of a quartz vein that assayed 30 ppm silver taken in area E, and the other an 8-ft spaced-chip sample (4S334) of iron-stained gneiss containing disseminated sulfides that assayed 0.10 ppm gold taken in area D. On the basis of 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.

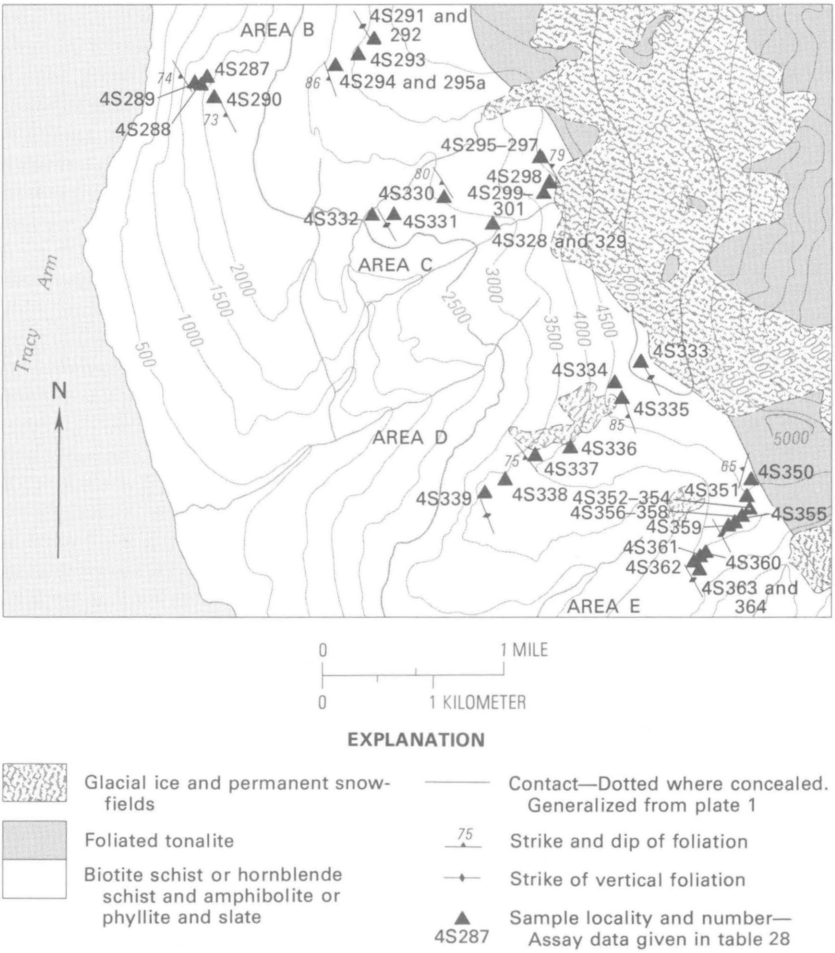

FIGURE 66.—Sumdum Glacier mineral belt between Sumdum copper-zinc prospect and Tracy Arm, sample localities. Lettered sample areas refer to table 28. U.S. Geological Survey, 1:63,360, Sumdum D–5, 1955.

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 deposit 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 (Cities Service Minerals Corporation, 1974) (figs. 67–69).

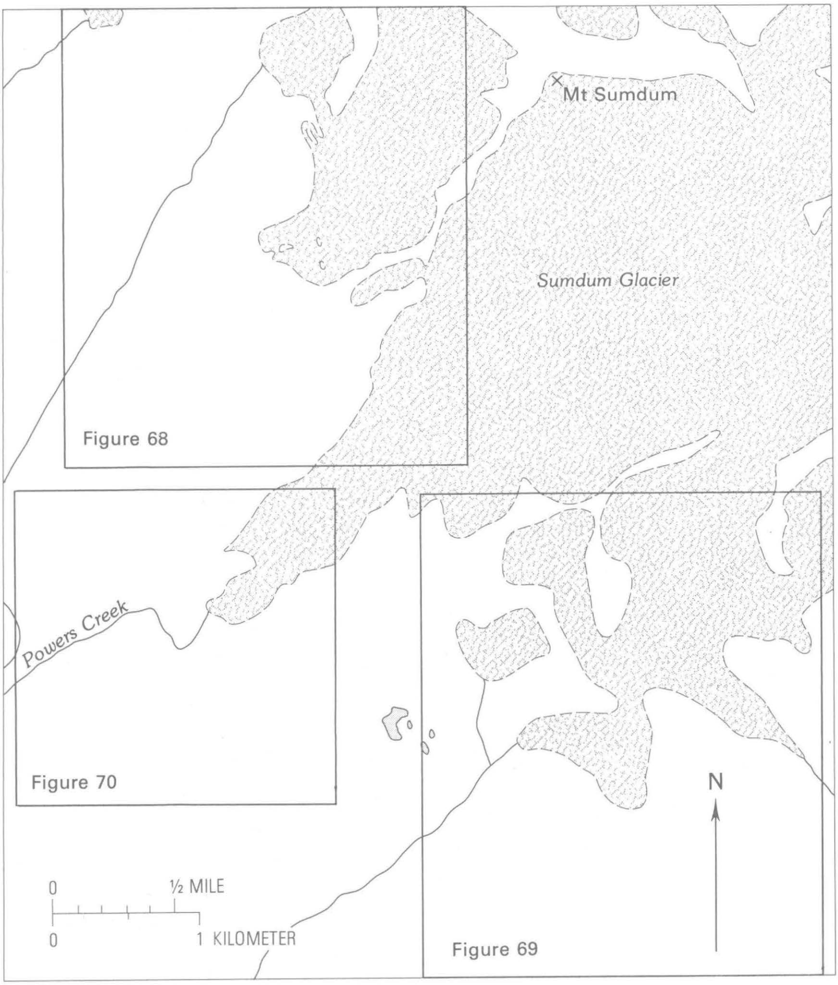

FIGURE 67.—Index map for Sumdum copper-zinc prospect. Base from U.S. Geological Survey, 1:63,360, Sumdum D–5, 1948.

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 1 to 50 ft 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 aline 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 ft, about half on

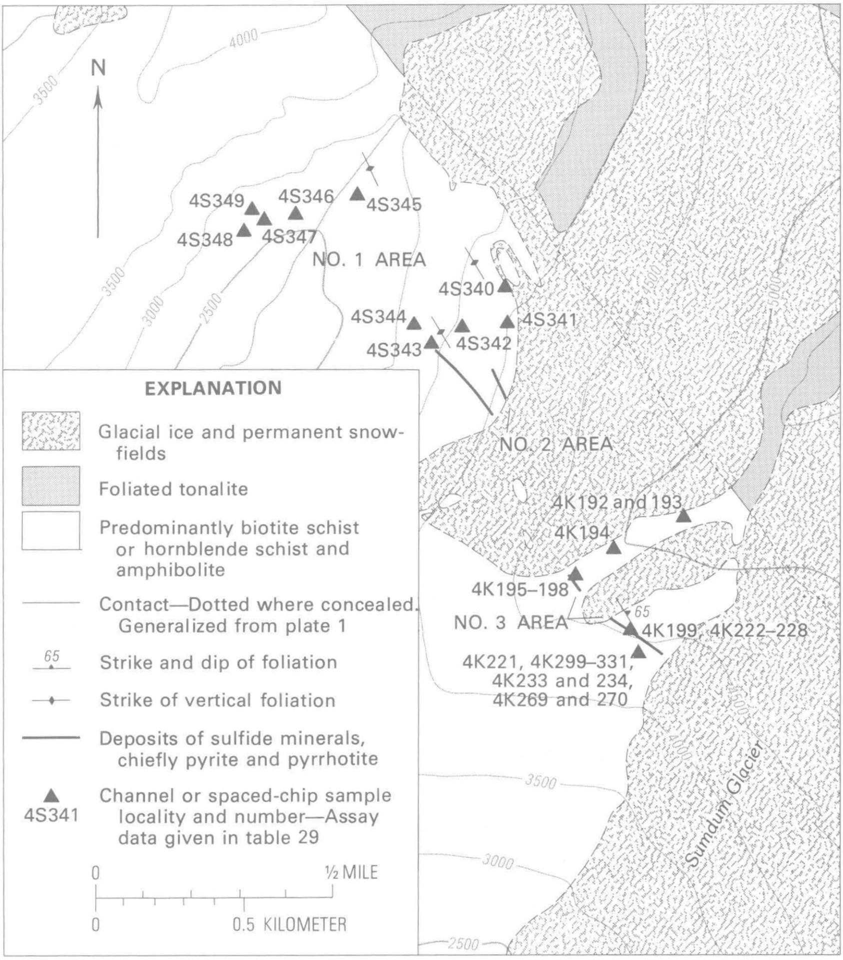

FIGURE 68.—Sumdum coppper-zinc prospect, north section, sample localities. Numbered sample areas refer to table 29. Base from U.S. Geological Survey, 1:63,360, Sumdum D–5, 1948.

each 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 ft or more, assuming continuity exists beneath the Sumdum Glacier.

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.

Mineralized intercepts in diamond drill holes vary from more than 50 ft to less than 10 ft, with the wider sections generally being nearer

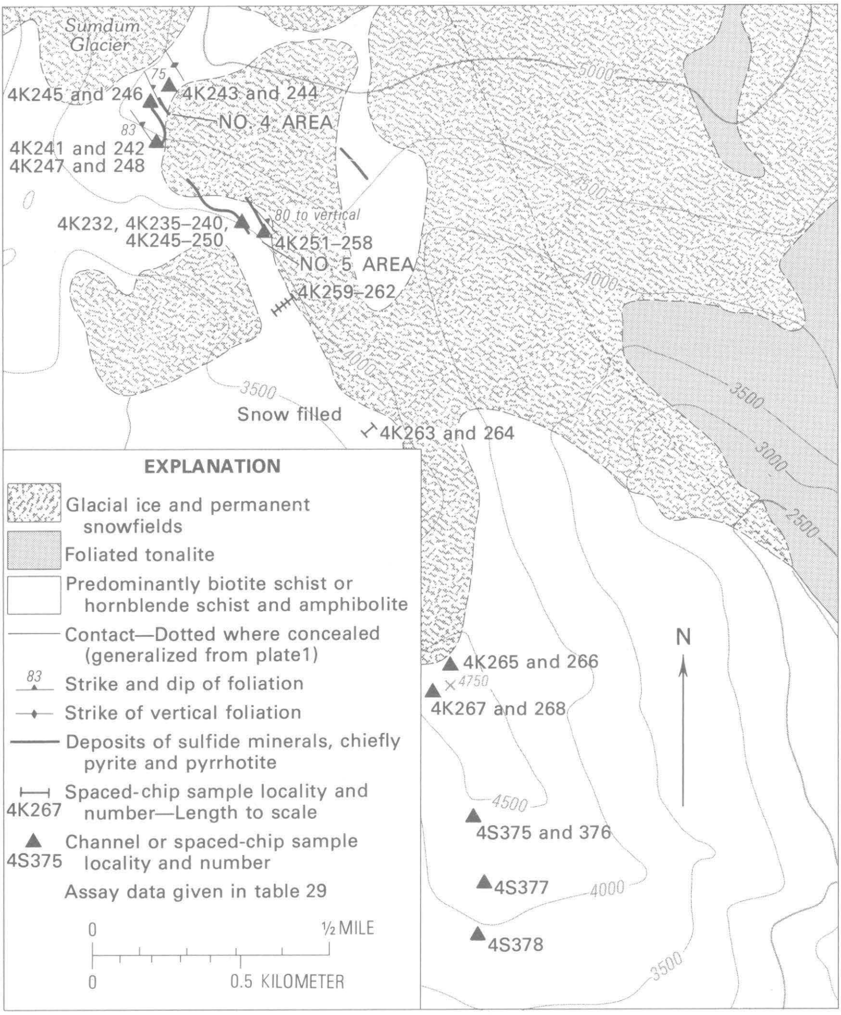

FIGURE 69.—Sumdum copper-zinc prospect, south section, sample localities. Numbered sample areas refer to table 29. Base from U.S. Geological Survey, 1:63,360, Sumdum D–5, 1948.

the fold crest. 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 oz per ton.

Host rocks are interlayered biotite-quartz-plagioclase and hornblende-plagioclase gneiss 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 crest of these minor folds on the limbs of a large, nearly isoclinal anticline; this accounts for the two subparallel mineralized zones in most areas that were drilled and surface sampled. Bodies in area No. 3 north of the glacier (fig. 68) follow brecciated fault zones and also are composed of two subparallel zones, which suggests that they are part of the same or a parallel fold structure.

Although the continuity of mineralized structure across the glacier cannot be clearly proved, it is suggested by the alinement 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 ft of diamond drilling, included 300 ft 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 ft 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 tested for in 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; 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 that were exposed during our study were channel sampled. Spaced-chip samples were also obtained across other measured sections where rocks appear particularly iron stained. These 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, 69).

Two 50-ft open cuts on the edge of southwest-facing cliffs at the extreme south end of the two zones in area No. 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 No. 2 and No. 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 No. 2 to one-half mile south of area No. 5 generally contained above background amounts of copper, zinc, and silver, and the spaced-chip samples 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 No. 2 were not anomalous. Samples from the 4,750-ft peak and mountain shoulder a mile south of the area No. 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 in the following two paragraphs; they represent only that part of the deposit that has been explored.

The mineralized zones exposed on both sides of the Sumdum Glacier aline and apparently extend beneath the glacier. The mineralized zones that are best explored by diamond drilling are at areas No. 3 and No. 5 located on the north and south sides of the glacier. The north end of the drilled section of the mineralized zone at area No. 3 is separated by 9,000 ft from the south end of the drilled section of the mineralized zone at area No. 5. This 9,000 ft consists of 1,500 ft that are drilled, 6,000 ft that are covered by glacier, and 1,500 ft that are poorly explored, with difficult access, and little explored. The 1,500-ft strike length (areas No. 3 and No. 5) that is drilled contains 1,870,000 tons of indicated resources with an average of 31.5 ft and an average grade (as estimated from assays) of 0.57 percent copper, 0.37 percent zinc, and 0.30 oz per ton silver. If the mineralized zones display the same width and grade under the glacier as they do at areas No. 3 and No. 5 and if they extend down dip for 1,000 ft (1,000 ft of down-dip mineralization is exposed), there is an inferred tonnage of 26,480,000 tons. If this is combined with an additional inferred tonnage of 217,000 tons at area No. 2, the total inferred tonnage for the prospect is 26,700,0000 tons with an average width of 31.4 ft and an average assay of 0.57 percent copper, 0.37 percent zinc, and 0.30 oz 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 per ton silver over a 12.7-ft width and 575-ft strike length to a depth of 540 ft; another part has 217,500 tons of inferred ore containing 1.15 percent copper and 0.37 percent zinc over a 12.5-ft width and 600-ft strike length to a depth of 290 ft.

POWERS CREEK ALTERED ZONE

Rusty siliceous schist is exposed at the head of Powers Creek one-fourth mile below the terminus of Sumdum Glacier (fig. 70); this recently glaciated terrain is nearly devoid of soil and vegetation. One

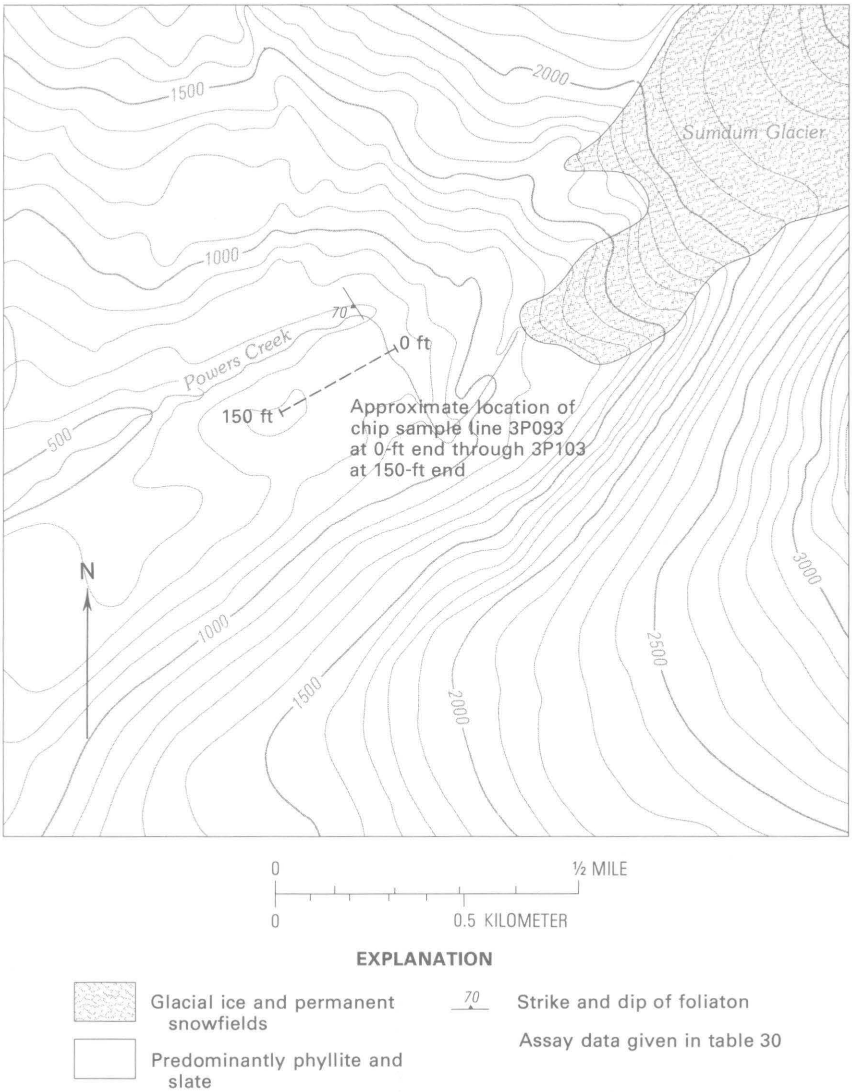

FIGURE 70.—Powers Creek stained zone, sample localities. Base from U.S. Geological Survey 1:63,360, Sumdum D–5, 1948.

lode claim, the Eclipse, reportedly was located in this vicinity in 1902. The conspicuous color and proximity to the Sumdum copper-zinc prospect suggested that the area was mineralized. During this study, 11 space-chip samples (with 2-ft interval) were taken in a composite section 1,130 ft long approximately normal to strike of the schist. The analyses (table 30) show only that all 11 samples contained 0.5–1.0 ppm silver, 3 samples had values of 15–30 ppm molybdenum, and

2 samples had values of 150–380 ppm zinc. 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 schist and gneiss of the area in general.

PORTLAND PROSPECT

The long-inactive Portland gold prospect is situated about 900 ft from the northeast shore of Endicott Arm and about 175 ft above sea level. A well-built but overgrown trail joins the workings with cabin ruins near the beach. Development consists of 305 ft of workings in three adits probably driven between 1890 and 1910 (fig. 71). The adits 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, including the Portland group itself, none could be identified on the ground. Spencer (1906) briefly discussed the property and reported a crosscut tunnel. Two other crosscuts probably were driven not long after that. Herried and Race (1963) sampled and mapped the two larger crosscuts. Information from their work has been incorporated into the figure and text of the present study.

The only surface exposures in the area are so heavily overgrown and weathered as to preclude sampling them; however, the three crosscuts present continuous exposures normal to the foliation. The analyses of 23 channel samples covering the full length of each of three crosscuts 189, 109, and 7 ft in length are reported in table 31. A majority are anomalous in one or more of the elements gold, silver, copper, lead, and zinc. The highest values for each of these elements was in a single 8-ft sample from the shore crosscut: 0.10 ppm gold, 10 ppm silver, 930 ppm copper, 1,800 ppm lead, and 3,400 ppm zinc. All the other values of interest were obtained in the long crosscut 33 ft below the short one. One sample from the long crosscut, the only other sample containing measurable gold (0.10 ppm), lies down dip from the gold value in the short crosscut. The intermediate length

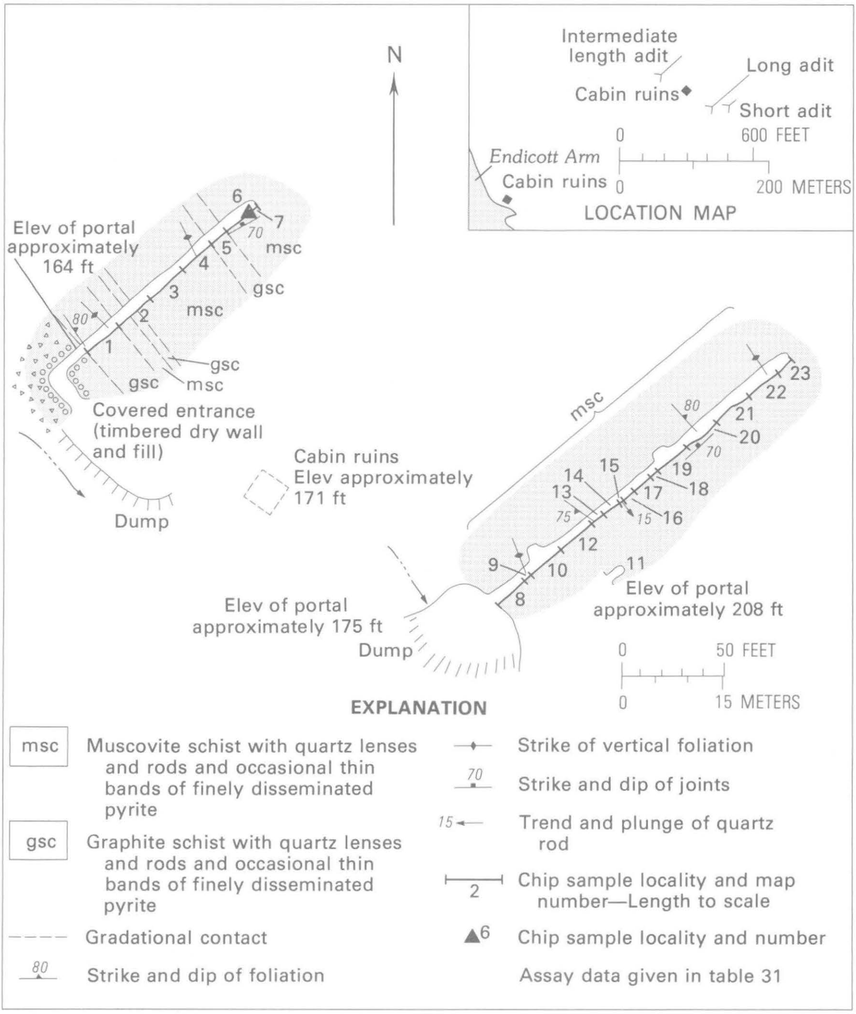

FIGURE 71.—Portland prospect, sample localities. Mapped by A. L. Kimball, T. L. Pittman, and F. R. Smith, August 1972.

crosscut 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 that suggest continuity with other base-metal prospects along the Sumdum Glacier mineral belt.

Iron-stained rocks that occur in a cove 2.5 miles southeast of the Portland workings were also sampled (table 31), but they 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.

BUSHY ISLANDS COPPER ANOMALY

Copper stains and traces of chalcopyrite in quartz stringers in phyllite occur on a wave cut bench just below the tide line at the north end of the Bushy Islands in Endicott Arm (fig. 72).

A chip sample was cut across 5.2 ft of the phyllite where slightly copper stained quartz stringers were most evident. These quartz stringers, 0.6 in. to 1.5 ft wide, locally contain traces of chalcopyrite, sphalerite, and malachite. They generally parallel the foliation. Analyses indicated 700 ppm copper, 1,600 ppm zinc, and 0.015 oz per ton silver. Search of the limited bedrock beach, the only good rock exposure in the vicinity, revealed no additional evidence of copper mineralization.

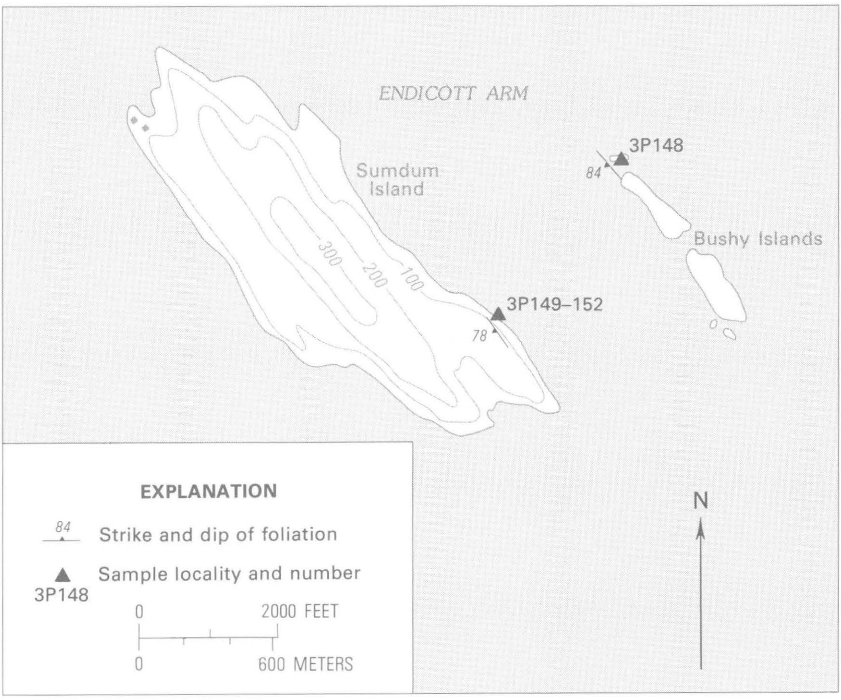

FIGURE 72.—Sumdum and Bushy Islands, sample localities. Bedrock is greenschist and greenstone, phyllite, and slate. Base from U.S. Geological Survey, 1:63,360, Sumdum C–5, 1951.

Sulfide stringers in biotite schist 0.6 mi to the southwest on the northeast shore of Sumdum Island were sampled. Samples were cut in three increments along a 27.9-ft section across foliation of the schist, which contains subparallel quartz stringers with bands of marcasite and pyrite along the schistosity. The central sample of the three—11.8 ft long—assayed 140 ppm zinc and 15 ppm molybdenum. A fourth sample, a composite of multiple cuts from a 0.1- to 0.5-ft-wide sulfide-bearing quartz vein, gave values of 80 ppm lead and 160 ppm zinc. Both localities are within the Sumdum Glacier mineral belt but are isolated due to their island location.

SULPHIDE PROSPECT

The Sulphide group, an active zinc-lead-silver prospect, is located 9 mi 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 ft of mineralization. Projected between cuts, the mineralization crudely defines a single zone with a length of about 830 ft (fig. 73). A fifth open cut (No. 3 in fig. 73) 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.

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 ft 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 ft in width.

During the present study, 21 channel samples were cut across the zone in four open cuts No. 1, No. 2, No. 4, and No. 5 (table 32)

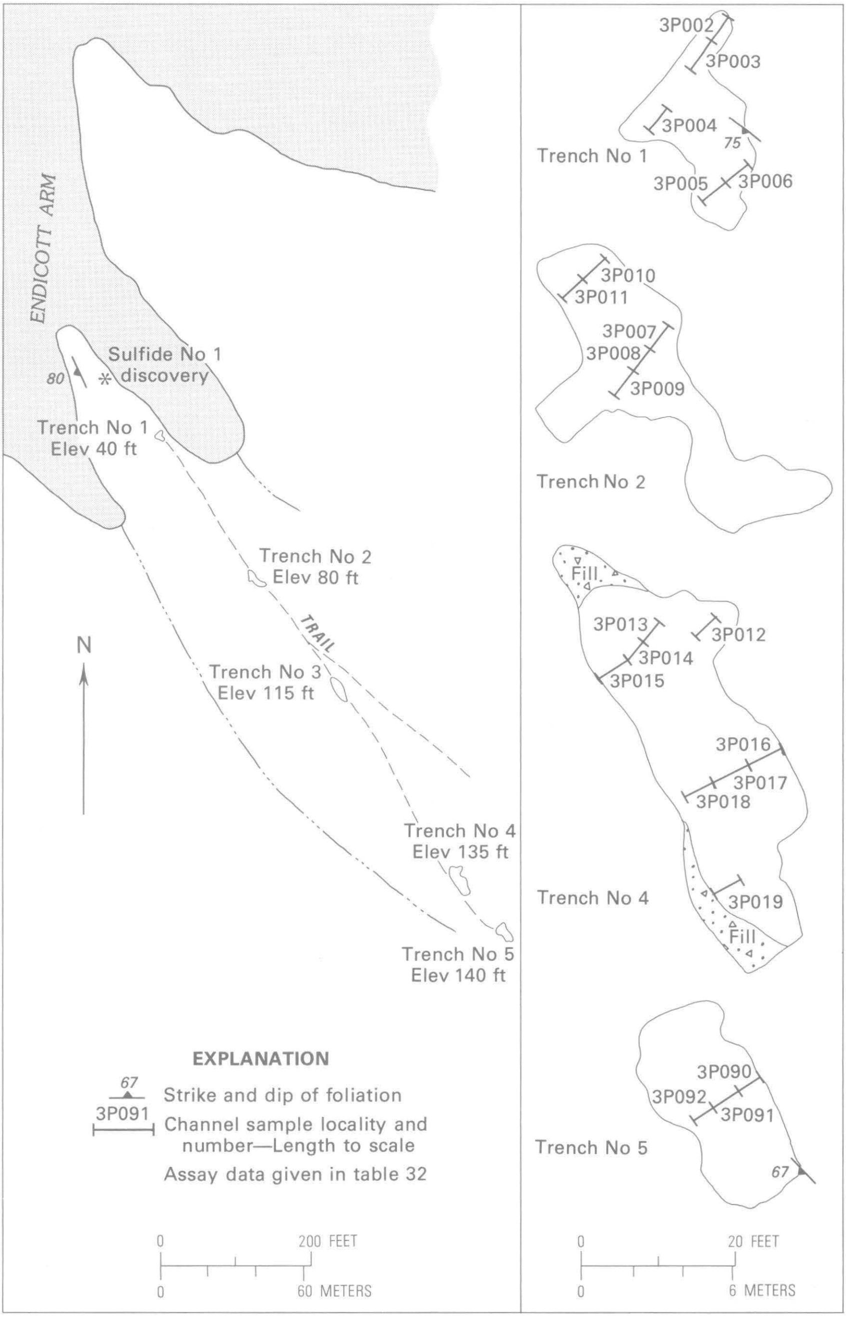

FIGURE 73.—Sulphide prospect, sample localities. Bedrock is gneiss. Mapped by T. L. Pittman and A. L. Kimball, June 1973.

over a distance of 800 ft. The five samples having the highest combined copper-lead-zinc-silver values ranged in length from 4.4 to 7.0 ft and contained 0.02–0.25 percent copper, 0.65–1.30 percent lead, and 1.25–1.90 percent zinc. Silver values ranged from 0.02 to 0.88 oz per ton, and gold from nil to 0.004 oz per ton. Sample 3P005, which cut across 5.5 ft of open cut No.1, probably had the highest combined values: 0.1 percent copper, 1.3 percent lead, 1.75 percent zinc, 0.88 oz per ton silver and a trace of gold, roughly $25 per ton at 1975 metal values.

REPORTED ANOMALY SOUTHEAST OF FORDS TERROR

A sediment sample taken in 1973 from an unnamed stream 5 mi southeast of Fords Terror was reported to contain 1,000 ppm tungsten, 2,000 ppm arsenic, and 30 ppm beryllium (loc. No. S131, pl. 2). This area was examined by a field party in 1974. 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 was 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 under the microscope was found to contain a grain of scheelite. The original stream-sediment analyses were not verified. No former activity is evident, and no claims are recorded.

POWERS CREEK PLACERS

Powers Creek was prospected and mined for placer gold intermittently for more than 40 years beginning 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 oz) 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 recovered from Powers Creek.

Powers Creek, which drains Sumdum Glacier, falls 1,300 ft through 2 miles of narrow canyons to Endicott Arm. Mining probably was done in the winter, when low water allowed access to the stream gravels. Because of the narrowness of the canyons, high water would probably have obliterated any vestige of old work.

Panned concentrates were taken at 13 sites randomly spaced along 600 ft of the stream near the mouth (fig. 74). The samples of the silt, sand, and gravel were taken from the stream bed and bank from between cobbles and large boulders and may represent the finer materials but not the boulder-strewn bank or bed as a whole. A few colors of gold were panned at most of the 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 concentrates were assayed separately. The amount 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 that 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-80 and plus-80 mesh sizes. Assay values range from 0.0031 oz per cubic yard to nil and suggest that deposits in the sampled localities are not viable under present economic conditions. However, the areas in the canyons that were probably mined were not accessible during this study.

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 is the dominant copper-bearing mineral. Assays show that small amounts of gold are also present in this deposit.

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 shows the areas visited and the sample localities.

A significant part of the valley at the head of Fords Terror is colored red by iron staining, apparently caused by 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 (detectable but not determinable) to 1 ppm silver. Table 34 gives 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 the

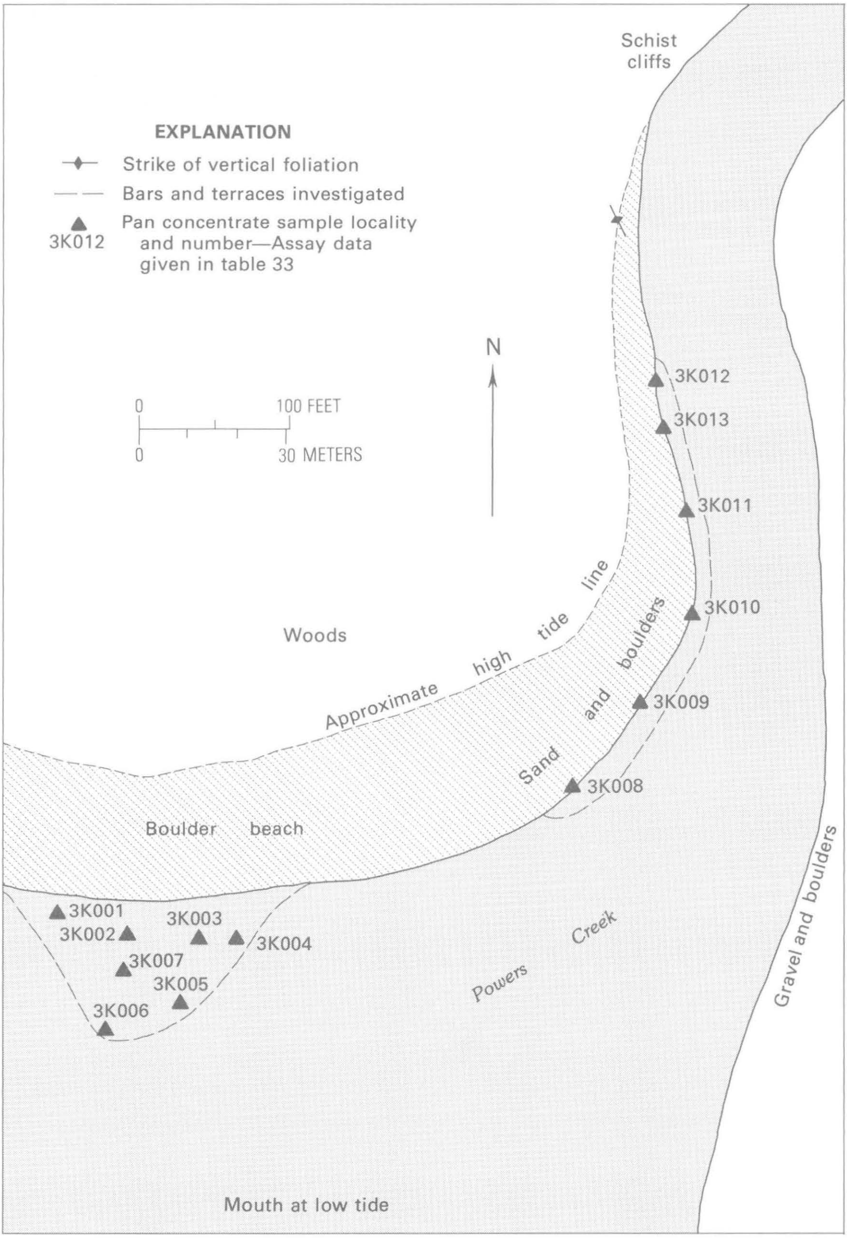

FIGURE 74.—Powers Creek placers, sample localities. Mapped by T. L. Pittman and A. L. Kimball, June 1973.

Fords Terror. Five samples taken across these fault zones near sea level indicated no significant metal values (table 34).

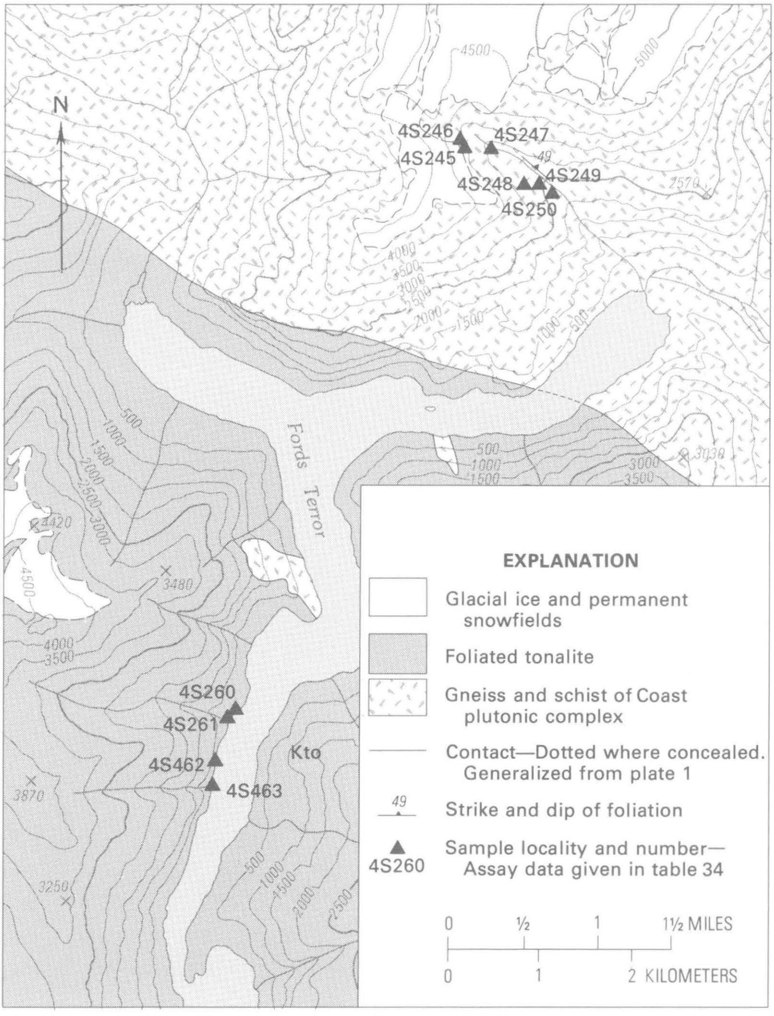

FIGURE 75.—Fords Terror area, sample localities. Base from U.S. Geological Survey, 1:63,360, Sumdum C-4, 1961.

ULTRAMAFIC BELT

The discontinuous belt of ultramafic rocks that extends in a generally northerly direction through the main part of the Coast plutonic complex (chap. A) was examined and sampled in reconnaissance. In addition to the usual chemical analyses, selected samples were analyzed for platinum-group metals.

As discussed in chapter D, 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 AND VICINITY

The Whiting River silver-gold prospect is located about 8 mi up the Whiting River and about 2 mi southeast of the river near the base of a glacier at an elevation of 2,900 ft. It can be reached by a 3.5-mi 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 (1925, p. 135) and the Juneau recording office records. The claims are not presently active.

A 4.5-ft-wide sulfide-bearing quartz vein in dolomitic limestone is exposed in an open cut on a steep hillside. About 80 ft of vein is exposed. The sulfides are arsenopyrite, pyrite, pyrrhotite, sphalerite, galena, and chalcopyrite; the gold values probably are in the arsenopyrite and the silver values in the galena. About 100 ft below this open cut, a 75-ft-long crosscut was driven in an apparent attempt to intersect the vein exposed at the open cut. Figure 76 shows the location of the open cut, adit, veins, and samples. Most of this work probably was done before 1908, as Brooks stated in 1909 (1909, p. 139) that this crosscut had been driven 70 ft at that time.

Study of the general geology of the area revealed several sulfide-bearing quartz veins in the dolomite country rock. The veins appear to be complexly faulted. The 4.5-ft-wide vein explored by the open cut disappears into barren dolomite just below the floor of the cut. Faulting is a likely cause for the abrupt truncation. About 70 ft southeast of the open cut, another sulfide-bearing quartz vein with a maximum thickness of 3 ft is exposed along a steep slope. It thins and pinches out at its upper end; its lower end decreases to a thickness of 2.5 ft, then disappears beneath a mudslope and fails to reappear in the rock below. Three additional mineralized veins were seen. The first, about 0.1 ft thick, is situated at the entrance to the crosscut. The second, about 0.2 ft thick, is isolated about 10 ft south of the crosscut. A third vein, about 0.8 ft thick, crops out for about 30 ft at the same elevation and about 250 ft southeast of the open cut.

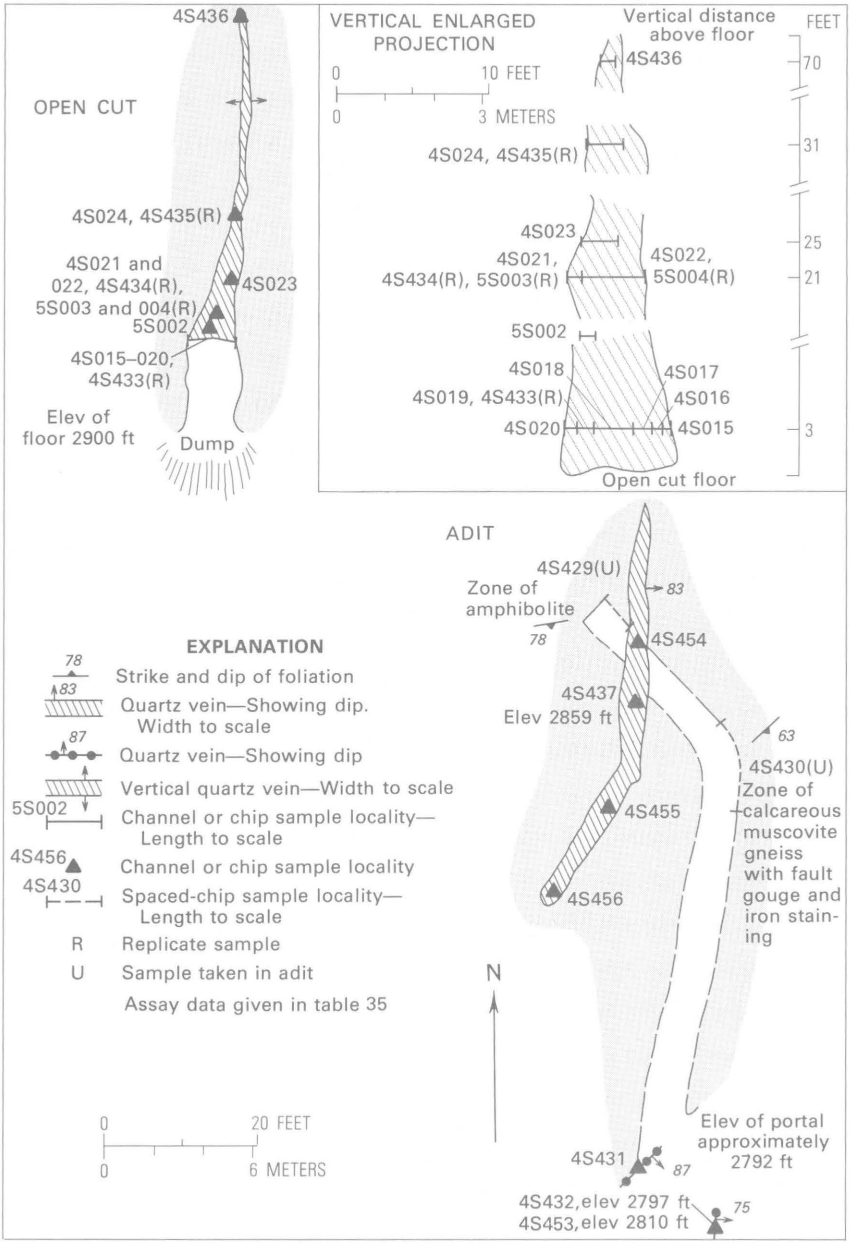

FIGURE 76.—Whiting River silver-gold prospect, sample localities. Plan and vertical projection. Bedrock is massive dolomitic limestone with local zones of gneiss and amphibolite. Mapped by J. C. Still, M. A., Parke, and K. R. Weir, August, 1974.

(This vein with sample 4S458 is not shown in figure 76.) All sulfide-bearing veins seen have an approximate strike of N. 5° 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 or high enough in grade to be of economic significance. Table 35 gives the assay results.

The 2,792-ft elevation crosscut is driven in dolomite through most of its 75-ft length except for 12 ft of calcareous muscovite gneiss 42 ft from the portal, and a 6-ft zone of amphibolite located near the face. The N. 45° W.-trending 50-ft extension of the crosscut should intersect the projected trend of the sulfide-bearing quartz vein exposed in the open cut about 105 ft down the dip of the vein. However, because the crosscut does not intersect the large quartz vein exposed on the surface 40 ft above it and because the open cut vein is not exposed on the surface below an elevation of 2,900 ft, a fault between the crosscut 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 significant assay returns of the five sampled. This vein truncates abruptly below the floor of the open cut at 2,900-ft elevation. Above the open cut, the vein gradually thins out vertically, and the sulfides pinch out an elevation of 2,970 ft and the quartz just above. The lower 51 ft of this sulfide-bearing quartz vein have the best assay values. Silver values range from 3.4 to 14.5 oz per ton calculated at a mining width of 4 ft and average 10.2 oz per ton. Average gold values of 0.09 oz per ton and average lead values of 2.20 percent were also obtained. These values would constitute ore only if several hundred thousand tons were found by subsurface exploration.

The area extending 1 mile northeast of the Whiting River silver-gold prospect was investigated. The Capped-Over claims 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-ft spaced-chip sample taken across an outcrop of iron-stained granodiorite assayed at 3 ppm islver. The area contained no significant mineralized zones and no claims.

A traverse was made along the ridge from 0.5 mile northeast of peak 4816 to peak 3894. This ridge is about one-half 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 are locally cut by quartz veins. No significant mineralized zones were found.

OTHER CLAIMS AND CLAIM GROUPS

More than one-third of the claims described in mining records as being 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 points of reference relative to claim locations, and vegetation growth. Because 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 sections 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 NO. 1 PROSPECT

In 1955, the BBH No. 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 (pl. 3, loc. C-7). The claim is inactive. In 1970, Gilbert R. Eakins (Eakins, 1975) examined the prospect and reported two pegmatite samples that assayed 35 to 45 ppm uranium.

Our investigation revealed four elliptical altered zones containing pegmatitic albite lenses in granodiorite at elevations of 45 ft, 60 ft, 85 ft, and 135 ft along a steep stream. The largest was about 120 by 20 ft, and the smallest was 45 by 35 ft. A geiger- counter 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 to 13 ft were taken across each zone. Uranium values ranged from 0.2 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 of too low a grade to be of economic interest.

STRAIGHT CREEK

Several claims were reported on Straight Creek before 1914. 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 schist contained no significant metallic values (pl. 3, loc. 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 claim or work was found. A channel sample of a 0.7-ft quartz vein in rusty-weathering schist indicated 370 ppm copper. Samples of a second vein and of the rusty schist in the area gave no significant values (pl. 3, loc. C–6).

EAST OF BUSHY ISLANDS

A 3-ft-thick quartz vein obliquely cutting phyllite just above high tide on the shore of Endicott Arm east of Bushy Islands gave only background metal value (pl. 3, loc. 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 that might have interested early prospectors.

HEAD OF WILLIAMS COVE

Conspicuous brown-weathering schist at the head of Williams Cove contains finely disseminated pyrite and quartz stringers that parallel foliation. Two chip samples across 9 ft of schist contained no anomalous values (pl. 3, loc. 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 schist with disseminated pyrite and irregular quartz stringers were spaced-chip sampled for 40 ft across the structure in two sample sections (fig. 64) in the Sumdum Glacier mineralized belt. Both contained 0.5 ppm silver and one 20 ppm molybdenum. Several claims were reported to have been located on this side of the arm before 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 Black lime claim (as it was referred to by the locator) was recorded in 1923 as situated 20 mi up Tracy Arm. Although the exact location of this claim is uncertain, Buddington and Chapin (1929) mapped marble in several locations in upper Tracy Arm and showed marble in one locality about 20 mi 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 ft in five spaced-chip samples (pl. 3, loc. 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. Burchard (1914, 1920) investigated marble resources of the region but did not describe any in the study area.

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-ft-wide area of quartz veining and minor sulfide mineralization in schist located just below the high tide line about 700 ft northeast of Point Coke. Figure 77 shows the location of the samples. Of 24 samples taken, only one sample, a 2.5-ft channel across a quartz-feldspar vein, had any metal values of significance, 300 ppm copper.

SPEEL ARM VICINITY

The Speel River quartz claim, staked in 1913, is described as being below the junction of Indian Creek and the Speel River and 6 mi. north from the iron rod on Star Point (pl. 3, loc. C–1). An investigation was made of the point from where the cable tram crosses the Speel River west to timberline at 2,300 ft 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 plutonic complex within about 10 mi of the Canadian border. The trend of these stained zones generally coincides with the trend of the complex but crosscutting relations are common. The most accessible of the prominent zones were investigated (pl. 3, locs. S–1 through S–12) and sampled. Sample results are given in table 36. Most samples were spaced-chip samples. Total sample length and interval were estimated in some instances and measured in others. Our investigation did not reveal significant mineralization, but some isolated samples were slightly anomalous in

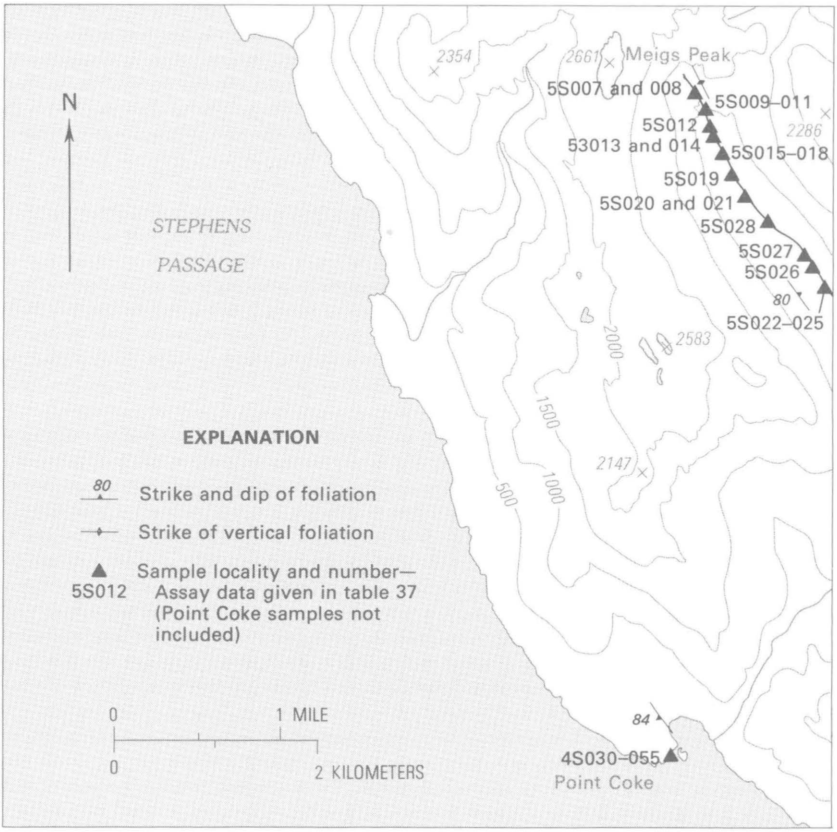

FIGURE 77.—Meigs Peak gold-zinc anomaly and Point Coke area, sample locations. Bedrock is greenstone and greenschist. Base from U.S. Geological Survey, 1:63,360, Sumdum D–6, 1951.

silver, gold, copper, molybdenum, lead, or zinc. Microscopic investigation revealed that the red stain was caused by the weathering of very finely disseminated pyrrhotite or biotite. In all cases the stain was a surface covering, only a fraction of an inch thick. There are no known mineral deposits near any of the areas investigated. The results of our investigations indicate that mineral deposits are not associated with the red-stained zones.

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-mi-long glacier flowing southeastward from Mount Fremont Morse (pl. 3, loc. S–1). Four spaced-chip samples from 19 to 40 ft long, 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 (pl. 3, loc. S–2) is in heavily iron-stained gneiss very similar to that on which the Red Mountain claim group was located about 1 mi along strike to the southeast. Some float fragments found in the gully below the stained zone contained small grains of iron sulfides. Neither a 24-ft 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, on an isolated nunatak in a high cirque roughly 2 mi to the northeast of the one described above (pl. 3, loc. S–3) was spaced-chip sampled (5K034) across its 90.5-ft width. The rocks are siliceous gneiss with moderate surface iron staining. The analysis indicated no significant metal values.

RED MOUNTAIN

Six Red Mountain claims were located in 1956 about 4 mi 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 localities, and the assay returns are shown in table 36. Nine spaced-chip samples ranging in length from 16 to 100 ft were taken of the most conspicuously stained areas. One sample contained 170 ppm zinc, two contained 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 was anomalous.

MOUNT BRUNDAGE STAINED ZONE

Conspicuous iron-stained siliceous gneiss on Mount Brundage is exposed in cliffs between 1 and 1.5 mi southeast of the summit (pl. 3, loc. S–5). Four spaced-chip samples ranging from 32 to 51 ft in length and 167 ft across foliation were found to contain no significant metal values; however, 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 ft 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 (pl. 3, loc. S–6) is located south of the Whiting River about 4 mi west of the Canadian border. Two conspicuous stained zones were investigated, one 100 ft wide located 0.3 mi southwest of Point Cook and the other 174 ft wide located 0.1 mi northwest of 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 on the north side of the Whiting River consist of metamorphic rocks just east of a contact with diorite (pl. 3, loc. S–7). Some of the fragments in the talus have thin veinlets of pyrrhotite along the foliation. Staining is intense only on vertical cliff faces. Two parallel 100-ft composite grab samples (5K001 and 5K002) collected in the talus face at the base of the cliffs contained 1 ppm silver.

STAINED ZONES NEAR SAWYER GLACIERS

Spaced-chip samples were collected in more or less continuous sections normal to structure in two localities 6 mi apart and about 2 mi west of the International Boundary. Ten spaced-chip samples were collected in the northern zone (pl. 3, loc. S–8), which is on both sides of a sharp northeast-trending ridge separating two icefields. Vivid red-brown staining on the high cliff forming the southeast side is as intense as any seen in the study area. Ten spaced-chip samples were collected at intervals of 4–5 ft across about 2,000 ft of structure in all. Three of the samples contained 15–20 ppm molybdenum and a fourth contained 70 ppm lead (table 36). No other anomalous values were obtained. Rocks are stained biotite gneiss with irregular granitic masses. No sulfides were seen in the field.

The second exposure (pl. 3, loc. S–9), 6 mi southeast, is composed of less colorful gneiss. Four samples with 2-ft spacing cross 400 ft normal to structure. A fifth random composite chip covered another 200 ft to the southwest. One of the first four samples contained 15 ppm molybdenum (table 36). None yielded interesting metal values.

Three other conspicuously stained zones near Sawyer and South

Sawyer Glaciers were sampled (pl. 3, loc. S–10, S–11, and S–12), mostly 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 10–30 ppm molybdenum, and one 30-ft 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 a pan concentrate sample were taken in the area (pl. 3, loc. M–3). Local rocks are dioritic. Five samples contained from 5 to 20 ppm molybdenum. Also, 0.35 ppm gold was found in the stream-sediment sample but not in the concentrate. More detail 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 sediment from the large glacial stream flowing northeast into the head of Tracy Arm (pl. 3, loc. M–5). A possible source is a body of alaskite west of the stream. During a brief followup examination, two stream-sediment and two pan concentrate samples were obtained from a stream draining the alaskite. A stream-sediment and a pan concentrate sample 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 that 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 mi from the mouth of the Whiting River (pl. 3, loc. M–1).

In an attempt to locate the source of this significant value, stream-sediment samples were taken at 17 locations along this stream from an elevation of 1,325 ft 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 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 mi northwest of the Tracy Arm elbow (pl. 3, loc. M–4). Examination of the area revealed several heavily iron-stained quartz pods parallel to the foliation of the gneiss. A 15-ft continuous-chip sample (5K041) across the largest and most heavily stained pod had 100 ppm molybdenum and 200 ppm copper. Two other chip samples across similar but smaller pods indicated insignificant metals. Traces of molybdenite and chalcopyrite were identified visually in the sample from the largest pod. Neither gold nor silver was 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-mi-long stream that originates one-half mile east of Meigs Peak on the Snettisham Peninsula. Seventeen stream-sediment samples were taken along 1.75 mi of the stream in an attempt to locate the source (fig. 77). Nine of the samples contained 0.5–5 ppm silver, two 0.15 and 0.70 ppm gold, thirteen 200–400 ppm zinc, and two 20 and 140 ppm lead (table 37). The anomalous samples were not grouped in a way that would indicate a possible bedrock source. Two rock samples, one taken of quartz stringer zone in schist containing disseminated pyrrhotite and the other of a quartz vein, contained no significant metals.

BEACH QUARTZ

About 2.25 mi southeast from Rock Point on Endicott Arm, a prominent quartz lens crops out on the beach. There is no record of claims being located in the area. Several channel samples were taken of this lens, and a 3.5-ft-long channel sample of the phyllite wallrock contained 0.15 ppm gold. The location of the samples is shown on plate 3, location M–7.

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, one at Chief Shakes 43 mi to the south and three more at least 90 mi to the south at Bell Island Hot Springs (Renner, White, and Williams, 1975). No hot springs has ever been identified in the study area (Waring, 1917; T. P. Miller, 1973), and our work indicates that any spring of substantial size is unlikely. 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 of a southeastern Alaska area 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 (Mathenson and Muffler, 1975).

OIL, GAS, AND COAL

The study area has never produced oil, gas, or coal, nor is it likely to. The metamorphic and batholithic rocks of the study area are 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 oil and gas potential of the Coast plutonic complex and adjacent areas is almost nonexistent. Similarly, coal is present in only a few scattered localities in southeastern Alaska, and none of these have quantifiable resource value (F. F. Barnes, 1967). The Tracy Arm–Fords Terror area and the rest of the Coast plutonic complex have no reported occurrences 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 underlain by marble (Burchard, 1914, 1920); however, these areas are inaccessible, and there is no local market for the stone. Sand and gravel are present in large quantities, 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.

NUCLEAR FUELS

There has been no production of uranium or thorium from the study area, and there are no significant prospects for future production. The single known radioactive occurrence is the previously discussed BBH No. 1 prospect, where a small outcrop of a pegmatitic phase of the plutonic complex contains up to 90 ppm equivalent uranium. This prospect is clearly subeconomic as now known. As discussed previously, geochemical sampling of the study area for uranium and thorium was not exhaustive, but the values indicate little more than a 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 mudstone (the Colorado Plateau type), or in Precambrian quartz-pebble conglomerate (Finch and others, 1973). Neither type of rock occurs in the study area. Major resources also occur in uraniferous phosphatic rocks and black shale; both are absent 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 for these types of deposits, but there is no geochemical or occurrence data that suggest their presence. 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 granite or rhyolite. The study area contains extensive areas of Tertiary granite; however, the geochemical data show only a few barely anomalous analyses of tin, tungsten, beryllium, and bismuth. Geologically, the absence of these deposits may be explained by the mesozonal character of the Tertiary granite. If tin, tungsten, beryllium, and bismuth deposits were ever associated with these granites, they probably would have occurred near the apical zones where the bodies intruded their host rocks. These zones have been eroded away and the mesozonal portions of the plutons have been exposed.

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Evaluation of Mineral Resources

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

GEOLOGICAL SURVEY BULLETIN 1525–F

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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 this evaluation includes economic constraints that limit mining of the resources.

The whole study area consists of two parts separated by a northwest-trending line that is drawn generally along the western edge of a foliated tonalite sill; to the northeast of the line is the main part of the Coast plutonic complex and to the southwest is the western metamorphic belt. The main part of the Coast plutonic complex consists of granitic bodies of varying size, shape, composition, and age, together with 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 before (and as a result of) this study.

MAIN PART OF COAST PLUTONIC COMPLEX

The batholithic rocks are well exposed where not covered by glaciers or water; nearly vertical, fresh exposures up to 900 m (3,000 ft) high are common, and the relief often provides panoramic views of several kilometers (miles) of outcrop. As part of the systematic geologic mapping and geochemical sampling, much of this outcrop was traversed on foot and 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 metamorphic rocks are markedly heterogeneous and are intricately deformed; but small epigenetic or strata-bound 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, 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.

Zones strongly stained reddish orange-brown occur in both the metamorphic and plutonic rocks of the complex; they range in size from a meter or so to about 2 km (a few feet to 1 mi) in diameter; most are less than 30 m (100 ft) 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 to a coating of "limonite" or goethite of iron in biotite and in sparsely disseminated iron sulfides. The zones locally cross geologic contacts and occur near the termini of glaciers. Many stained zones occur in areas of present-day glacier runoff and in the runoff areas of the more extensive and thicker glaciers of the recent geologic past.

The potential for economic mineralization in the ultramafic rocks of the main part of the Coast plutonic complex is low. The bodies are small, discontinuous, and inaccessible. 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 traces 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 gold lodes near Windham Bay, and the Sulphide and Holkham Bay claim groups. The present study has identified two areas of mineral-resource potential within the western metamorphic belt in the study area; these are the Sumdum Glacier mineral belt and the Endicott Peninsula, with the Sumdum Glacier mineral belt being of greater importance.

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, because of (1) proximity to areas with recognized potential, (2) similarity of rock types 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 mi) along the Coast plutonic complex and contains the largest number of metallic resource occurrences in the study area. The belt is about 0.3–1.6 km (0.2–1.0 mi) wide with a clearly defined northeast boundary to the mineralization at the edge of the plutonic complex. Three deposits that have economic potential and warrant further exploration are the Sweetheart Ridge mineralized zone gold-copper occurrences, 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 commerical 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 to 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 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 vertical dipping banded sulfides from 0.6 to 3 m (2 to 10 ft) in width that have been traced through outcrops and pits for 350 m (1,150 ft) 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

ft) and averaging 3.42 percent zinc, 1.42 percent coper, 15 g per metric ton (0.43 oz per ton) silver and 0.27 g per metric ton (0.008 oz per ton) gold along a 259-m (850-ft) 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 million and $10 million.

The Sumdum copper-zinc deposit consists of massive and disseminated sulfides exposed in two steeply dipping parallel zones 0.3–15 m (1–50 ft) 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 1.6 km (mile-wide) Sumdum Glacier, they have a strike length of about 3,050 m (10,000 ft). Assuming continuity of grade and width between sampled intercepts in diamond drill holes and surface open cuts, and on the basis of a 2,700 m (9,000 ft) strike length with an average width of 9.6 m (31.4 ft) to an estimated depth of 305 m (1,000 ft), 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 oz per ton) silver.

The Sweetheart Ridge gold-copper deposit consists of a mineralized zone up to 60 m (200 ft) wide that has been sampled for 600 m (2,000 ft) along strike. A 1.7-m (5.5-ft) wide by 44.8-m (147-ft) long portion of the zone averaged 8 g per metric ton (0.23 oz per ton) gold and 0.7 percent copper. This section to an established depth of 30.5 m (100 ft) 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 oz per ton) and silver up to 20.9 g per metric ton (0.609 oz per ton). The topographic depression that this mineralized zone follows can be traced for 9 km (5.5 mi). This depression is unexplored; it may indicate the actual extent of the mineralization.

Although the three prospects described have the greatest economic mineral potential, the entire 52-km (32-mi) 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. The Tracy Arm zinc-copper prospect, found in 1916, is largely concealed, and it is doubtful that it would be found during this study. The 610-m (2,000-ft) long Sweetheart Ridge mineralized zone is above timberline and was first indicated during this study as the result of an anomalous rock-geochemical sample collected in 1973. Followup on that sample and a search for old claims led 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 was directly detectible from the stream-sediment geochemical information obtained during the study.

Considering this exploration history and the terrain, we estimate 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 as many as 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 3 deposits which have already been found, and (2) there may be more than 15 deposits. These calculations do not consider non-outcropping deposits, which could not be discovered by surface exploration.

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), we estimate that the belt contains the following gross in-place values (at 1976 prices) 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 of excess of \$1 million. All three are potentially minable. As many as 12 more deposits of at least comparable value 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 a 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-copper deposit, the Sumdum Chief gold mine, the Taylor Lake area prospect, the Holkham Bay gold prospect, and the Windham Bay area gold lodes and placers. The deposits in the area consist largely of sulfide minerals either disseminated through, or in lenses and stringers along, the foliation in bleached and altered zones in phyllite- or in 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 mi) south of Sanford Cove was the major mine in the area; between 1895 and 1904 it produced about 680,400 g (24,000 oz) of gold from ore that averaged about 14 g per metric ton (0.4 oz per 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 ft) 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 mi) 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 crosscutting the foliation of the low-grade metamorphic rocks. The gold content of veins rarely exceeds 9 g per metric ton (0.25 oz per 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 areas has a similar geologic setting and large sulfide-bearing quartz 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 deposits consist of disseminated pyrite and sphalerite and lesser amounts of galena and copper sulfides in altered muscovite-quartz-feldspar schist. Locally, the sulfides form lenses less than 0.9 m (3 ft) long and usually less than 0.3 m (1 ft) wide. The mineralization occurs in broad irregular altered zones a few hundred meters (about a thousand feet) 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, which suggests the possibility of volcanogenic deposits. In addition, small hypabyssal intrusions 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) would be a likely exploration and development target. It contained a gross in-place metal value between $1 and $10 million at 1976 prices, and 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.

ULTRAMAFIC BODY AT WINDHAM BAY

The ultramafic body at Windham Bay belongs to the belt of "Alaska type" ultramafic bodies that 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, biotitite, pyroxenite, and diorite discontinuously exposed along the shores of Windham Bay. It is associated with a moderately strong positive magnetic anomaly (pl. 1) that indicates some similarity to the Snettisham body about 48 km (30 mi) 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 (pl. 1) 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 porphry copper or stockwork molybdenum deposits in the study area appears to be low. The main part of the Coast plutonic complex apparently lacks stockworks, zones of argillic alteration, or shallow intrusions. Rock and available stream-sediment geochemical analyses do not suggest any such mineralization. However, the recent discovery of a major molybdenite occurrence in the Coast plutonic complex east of Ketchikan (R. L. Elliott, oral commun., 1976) may stimulate exploration for this type of deposit in the complex and adjacent rocks. The western metamorphic belt is geologically more favorable than the rest of the Coast plutonic complex for porphyry copper or stockwork molybdenum deposits, but no such mineralization was found nor was there any geochemical evidence for such deposits.

GOLD PLACERS AND RADIOACTIVE MINERALS

At least 56,700 g (2,000 oz) of gold were reported to be 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 gravel 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 conglomerate and sandstone found elsewhere in the world are totally absent. Alkalic rocks, which are often associated with uranium deposits, are also absent. 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 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.

REFERENCES CITED

Spencer, A. C., 1906, The Juneau gold belt, Alaska: U.S. Geological Survey Bulletin 287, 137 p.

U.S. Bureau of Mines and U.S. Geological Survey, 1976, Principles of the mineral resource classification system of the U.S. Bureau of Mines and the U.S. Geological Survey, U.S. Geological Survey Bulletin 1450–A, 5 p.

TABLES 1–37

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 oz troy; 1 ppm = 0.0001 percent = 0.0291667 oz troy per short ton = 1 gram per metric ton; 1 oz per ton (Au or Ag) = 34.286 ppm = 0.0034286 percent]

Ppm	Percent	Oz per ton	Oz 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	.0514	14.538	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

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	Kgs	3	0.04 X 10^{-3}
Coast plutonic complex:			
Granodiorite	Tgr	6	.74 X 10^{-3}
Biotite gneiss	TKgn	1	.14 X 10^{-3}
Quartz diorite	TKto	2	.66 X 10^{-3}
Granitic gneiss	Kgn	1	.05 X 10^{-3}
Biotite gneiss	Kgn	1	1.67 X 10^{-3}

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 (kg/m^3)		
		Minimum	Maximum	Average
Western metamorphic belt--	46	2650	3070	2810
Plutons in above belt-----	6	2580	3010	2830
Coast plutonic complex	9	2700	2780	2760
Eastern metamorphic belt--	8	2630	3000	2740
Plutons in above belt-----	4	2540	2660	2620

TABLE 4.—*Levels of anomality for selected metals in stream sediments as used on plate 2 and figures 9 to 22*

Element	Weakly anomalous at or above: (ppm)	Distinctly anomalous at or above: (ppm)	Element	Weakly anomalous at or above: (ppm)	Distinctly anomalous at or above: (ppm)
Ag	0.7	3	Pb	50	100
As	300	none	Sn	10	20
Be	1.5	none	Au[1]	.10	.30
Cr	500	5000	Cu[1]	100	150
Cu	100	150	Hg[1]	.04	.10
Mo	10	20	Pb[1]	50	100
Ni	150	300	Zn[1]	200	none

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

TABLE 5.—*Anomalous stream-sediment samples collected by the Geological Survey in the Tracy Arm-Fords Terror wilderness study area, Alaska*

Sample number	Field number	Semiquantitative spectrographic analyses										
		Mn (10)	Ag (0.5)	As (200)	Be (1)	Co (5)	Cr (10)	Cu (5)	La (20)	Mo (5)	Ni (5)	Pb (10)
S001	74AF051	700	N	N	L	10	50	7	70	N	10	15
S002	74DB062	300	.7	N	L	L	10	L	30	N	L	15
S003	74DB056	1000	N	N	N	20	500	50	N	L	70	L
S004	74DG036	1000	N	N	1.00	7	50	20	100	30	15	15
S005	74DG034	700	N	N	1.00	7	30	10	N	30	5	15
S006	74DG039	500	N	N	L	L	L	L	N	30	5	20
S007	74DG024	1000	N	N	1.00	10	70	70	70	30	70	20
S008	74DG022	700	N	N	1.00	7	30	L	150	15	5	20
S009	73AF155	700	N	N	1.00	10	50	5	100	15	15	10
S010	73AF131	1000	.7	N	1.50	15	70	15	100	N	30	L
S011	74DG017	700	5.0	N	1.00	15	70	70	20	7	70	L
S012	74AF018	1500	N	N	1.00	15	70	70	N	5	70	10
S013	74DG045	700	N	N	L	10	50	100	20	N	15	20
S014	74AF015	1000	1.5	N	L	5	L	200	N	N	L	50
S015	74DG008	1000	[1]100.0	N	1.00	5	L	L	20	N	L	20
S016	73AF115	1000	N	N	1.00	20	30	10	50	N	15	50
S017	73BC292	1000	.7	N	1.00	20	150	10	100	N	30	15
S018	73AF113	700	N	N	1.00	10	20	L	30	15	5	20
S019	73BC296	1000	N	N	1.00	15	70	5	100	30	10	20
S020	74AF006	700	N	N	L	5	10	5	20	N	10	20
S021	73AF135	1000	.7	N	1.00	15	70	7	50	N	20	20
S022	73BC304	1000	L	N	1.00	20	100	100	50	N	50	10
S023	73BC305	1500	N	N	1.00	30	70	10	20	10	20	20
S024	73BC272	1000	N	N	1.00	30	700	70	20	N	100	L
S025	73BC273	1000	N	N	L	30	700	100	N	N	100	10
S026	73BC274	1500	N	N	1.00	30	500	20	150	N	100	10
S027	73BC269	1500	N	N	1.00	20	70	7	100	50	20	15
S028	73BC271	1000	N	N	1.00	20	150	10	100	15	30	15
S029	73DB132	1000	N	N	1.00	30	500	15	50	N	150	10
S030	73DB131	1000	N	N	1.00	50	1000	5	L	N	1000	L
S031	73DB128	700	1.0	N	1.00	20	200	50	70	N	100	10
S032	73DB129	1000	N	N	1.00	20	500	20	50	N	100	10
S033	73DG209	1000	N	N	1.00	50	2000	5	20	N	1500	L
S034	73DB097	1000	N	N	1.00	30	300	5	20	N	200	10
S035	73DG211	1500	N	N	1.00	30	700	10	30	N	150	10
S036	73AF091	700	N	N	L	50	1500	100	30	N	1000	10
S037	73DB079	1500	N	N	L	30	500	50	30	N	150	L
S038	73DB080	1500	N	N	L	30	500	30	30	N	150	L
S039	73DB073	1000	N	N	1.00	15	200	15	70	N	50	10
S040	73DB110	1000	N	N	1.00	20	100	7	100	N	30	10
S041	73DB116	1000	N	N	1.00	15	70	5	70	15	20	10
S042	73DB105	1000	N	N	1.00	15	50	L	100	10	10	10
S043	73AF080	1000	.5	N	1.00	15	100	10	50	10	20	10
S044	73DG198	1000	N	N	L	20	30	100	20	N	20	L
S045	73DG197	1500	N	N	1.00	30	30	100	20	N	20	10
S046	73AF078	1000	N	N	1.00	20	100	10	20	10	30	L
S047	73DG196	5000	N	N	L	30	50	20	20	N	30	10
S048	73AF075	700	.7	N	1.50	20	100	30	30	7	30	10
S049	73AF076	1000	N	N	1.00	30	150	30	20	10	50	10
S050	73DB090	700	.7	N	1.00	20	150	50	30	7	50	10
S051	73DB091	1000	.7	N	1.00	20	150	50	30	10	50	10
S052	73DB092	700	1.5	N	1.00	20	100	50	50	5	50	L
S053	73DB087	700	1.0	N	1.00	20	200	10	50	N	50	L
S054	73AF057	2000	N	N	1.00	50	500	50	50	N	150	10
S055	73DB152	700	.5	N	1.00	10	150	15	20	10	20	L
S056	73AF073	1000	L	700	1.00	20	150	20	20	N	30	10
S057	74DB111	1500	N	N	1.00	15	50	20	N	N	30	L
S058	73DB041	2000	N	N	1.00	30	500	20	L	N	100	10
S059	73DB044	1000	L	N	1.00	20	100	150	20	N	50	10
S060	73DB039	1000	N	N	L	50	70	50	L	N	30	10
S061	73DG129	1500	N	N	1.00	20	300	20	20	N	50	10
S062	73DG124	1500	.5	N	1.00	20	500	20	20	N	50	15
S063	73BC204	1000	N	N	1.00	30	150	10	20	N	100	15
S064	73DG123	1000	N	N	1.00	20	150	70	20	7	50	10
S065	73DG136	700	N	N	1.50	15	70	10	70	N	30	50
S066	73HB013	700	N	N	1.00	30	500	15	70	N	150	10
S067	74DG238	5000	N	N	L	50	500	50	L	N	70	15
S068	73DG183	1000	N	N	1.00	15	100	100	50	N	30	10
S069	73DG185	1000	N	N	1.00	30	500	20	100	N	150	10
S070	73HB022	3000	N	700	1.00	30	150	10	30	N	50	10

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

TABLE 5.—Continued

Sample number	Semiquantitative spectrographic analyses--Continued						Atomic absorption				
	Sc (5)	Sn (10)	Sr (100)	V (10)	Y (10)	Zr (10)	Au (0.1)	Cu (5)	Hg (2)	Pb (5)	Zn (10)
S001	15	N	500	150	30	1000	0.20	15	0.02	5	20
S002	5	N	200	30	15	150	N	5	L	5	20
S003	30	N	300	150	10	30	N	55	L	10	55
S004	15	N	300	100	50	300	N	20	.02	5	40
S005	10	N	300	100	15	70	N	20	.02	5	50
S006	5	N	300	20	L	30	N	L	.02	5	35
S007	15	N	200	70	30	150	N	50	.02	20	80
S008	10	N	200	70	30	150	N	5	L	15	45
S009	15	N	500	150	30	200	N	10	.02	5	35
S010	20	N	500	200	50	300	N	30	N	10	45
S011	15	N	300	200	30	150	N	85	.10	10	220
S012	15	N	300	200	30	200	N	100	.04	5	65
S013	15	N	700	70	15	30	N	15	.02	5	20
S014	15	N	500	70	15	200	L	L	.10	5	40
S015	15	N	700	100	30	150	N	L	.02	5	50
S016	15	N	500	150	20	150	N	20	.04	25	90
S017	20	N	1000	100	50	150	N	30	N	40	40
S018	10	N	300	70	15	100	N	10	.04	10	40
S019	20	N	500	200	30	200	B	15	.02	10	70
S020	15	N	500	70	10	150	.60	10	.12	15	90
S021	20	N	500	150	30	200	N	25	N	10	40
S022	15	N	300	150	20	100	N	30	.02	10	65
S023	20	N	300	200	30	50	N	25	.04	20	95
S024	20	N	300	200	20	100	N	70	.02	10	40
S025	20	N	200	150	20	70	N	50	.02	5	35
S026	20	N	500	200	30	300	N	40	N	10	30
S027	20	N	700	150	50	200	N	15	N	10	40
S028	20	N	500	200	20	150	N	15	.02	10	25
S029	20	N	200	150	30	200	N	40	.02	10	40
S030	20	N	200	150	20	30	N	20	N	10	20
S031	20	N	500	150	30	200	N	25	.04	5	20
S032	50	N	500	200	30	100	N	30	N	5	30
S033	10	N	200	100	15	50	N	15	N	15	45
S034	20	N	300	150	20	100	N	20	.02	5	40
S035	20	N	300	150	30	100	N	45	.04	10	40
S036	15	N	200	100	20	70	N	90	.12	10	65
S037	50	N	200	300	30	150	N	30	.02	L	15
S038	50	N	200	300	30	300	N	35	.02	L	15
S039	20	10	300	300	50	1000	N	30	N	10	15
S040	20	N	700	200	50	1000	N	20	N	5	[2]10
S041	20	N	500	150	30	300	N	20	N	5	30
S042	20	N	500	150	20	150	N	10	N	5	25
S043	20	N	300	200	30	100	N	30	.08	10	75
S044	30	N	150	200	20	50	N	110	.20	10	80
S045	20	N	150	150	30	20	N	110	.12	15	160
S046	30	N	200	200	30	150	N	30	.02	5	35
S047	20	N	200	200	20	70	N	55	.06	15	240
S048	20	N	200	150	30	150	N	45	.06	15	120
S049	30	N	200	150	30	100	N	50	.06	10	65
S050	20	N	150	200	20	150	N	90	.16	10	230
S051	20	L	150	200	30	70	N	80	.08	10	160
S052	20	N	200	200	30	100	N	80	.08	10	120
S053	20	N	500	150	30	100	N	35	.06	10	55
S054	30	10	700	150	30	150	B	45	.06	10	75
S055	10	N	150	100	20	50	N	75	.40	10	40
S056	30	N	200	150	30	200	N	45	N	5	50
S057	30	N	150	150	20	70	N	25	.30	10	60
S058	30	N	300	300	20	100	N	30	.02	20	35
S059	30	N	200	200	30	100	N	35	.02	10	40
S060	30	L	200	300	20	150	N	120	.04	15	130
S061	30	15	200	200	30	200	N	55	N	5	55
S062	30	N	300	200	30	150	N	45	.06	10	65
S063	30	N	300	200	30	1000	.30	50	N	10	50
S064	20	10	500	150	20	100	N	65	.02	15	70
S065	20	N	300	150	20	200	N	40	.04	45	210
S066	20	N	500	200	30	200	N	20	.04	10	30
S067	30	N	300	150	20	70	N	35	.60	10	55
S068	15	N	200	150	20	100	N	40	.04	10	80
S069	20	N	500	200	20	200	N	30	.06	10	40
S070	20	N	500	150	20	300	N	20	.04	10	60

[2]Spectrographic analysis indicates 500 ppm.

TABLE 5.—Continued

Sample number	Field number	Semiquantitative spectrographic analyses										
		Mn (10)	Ag (0.5)	As (200)	Be (1)	Co (5)	Cr (10)	Cu (5)	La (20)	Mo (5)	Ni (5)	Pb (10)
S071	73DB015	1000	N	N	1.50	30	150	50	50	N	50	10
S072	73DB008	700	N	N	1.00	7	20	N	30	N	L	10
S073	73AF003	5000	N	N	1.50	50	10	30	100	7	5	50
S074	73AF005	5000	N	N	1.50	70	50	10	70	10	20	20
S075	73AF006	5000	N	N	1.00	50	70	100	100	N	30	30
S076	73DB001	1500	N	N	1.50	15	15	15	50	7	10	50
S077	73DB002	1500	N	N	1.00	10	50	5	100	N	10	50
S078	73DB004	700	.5	N	1.00	10	70	10	70	5	30	10
S079	73DG182	700	.7	N	1.00	10	150	20	30	N	50	10
S080	73DG181	1000	.7	N	1.00	20	150	50	100	7	50	15
S081	73AF012	3000	N	N	1.00	70	30	50	50	10	20	15
S082	73AF015	100	N	N	1.00	N	20	L	30	N	5	10
S083	73AF016	5000	.5	N	1.00	100	20	50	30	N	5	200
S084	73AF017	5000	.5	N	1.00	100	30	70	20	N	30	100
S085	73AF019	3000	N	N	1.00	70	70	70	30	7	50	50
S086	73DG179	1500	5.0	N	1.50	30	30	70	100	7	50	100
S087	73DG186	1000	N	N	1.00	30	500	20	100	N	150	10
S088	74DB124	1500	N	N	1.00	30	700	70	200	N	150	10
S089	74DB123	1000	N	N	L	50	500	70	100	N	100	L
S090	74DB122	2000	N	N	1.00	50	300	70	100	N	150	10
S091	74DB114	1000	.7	N	L	30	500	70	100	N	100	10
S092	74DB116	1000	N	N	1.00	50	500	70	150	N	150	10
S093	74DB115	1000	N	N	1.00	30	500	70	70	N	150	L
S094	74DG122	1500	L	N	L	20	150	100	30	N	70	10
S095	74DB219	1000	.5	N	L	30	150	70	30	N	70	15
S096	74DG249	1000	L	N	L	20	100	30	50	N	50	15
S097	74DG177	1500	N	N	L	30	150	30	L	10	20	15
S098	74DG119	1500	N	N	L	15	70	30	N	N	15	15
S099	74DG118	1500	L	N	.50	15	70	30	70	10	15	20
S100	74DG116	1000	1.0	N	1.00	15	150	70	L	10	70	10
S101	74DG180	5000	N	N	L	20	100	30	20	N	30	15
S102	74DG181	1500	.5	N	L	100	150	200	20	N	50	10
S103	74DG182	1000	N	N	L	30	150	100	N	N	20	L
S104	74AF112	1000	L	N	L	30	200	70	20	5	70	10
S105	74AF111	1500	L	N	L	50	150	50	20	N	50	L
S106	74AF107	1500	N	N	L	50	100	70	N	N	20	10
S107	74AF106	1000	N	N	L	50	700	100	N	N	50	10
S108	74AF109	1500	N	N	L	50	300	70	30	N	50	15
S109	74DG109	1000	N	N	L	20	100	150	N	N	50	L
S110	74DG103	500	.5	N	L	15	100	50	N	N	20	50
S111	74DG104	1000	N	N	L	20	100	150	30	N	50	15
S112	74DG097	1000	N	N	L	15	100	100	N	N	20	L
S113	74DG099	700	L	N	L	15	50	100	N	N	15	10
S114	74DG223	3000	L	N	L	30	100	70	N	N	50	70
S115	74DG220	5000	N	N	L	30	50	70	N	N	15	L
S116	74DG217	700	.5	N	L	20	30	70	L	5	30	10
S117	74DG113	700	L	N	L	20	100	70	L	L	70	15
S118	73AF026	2000	L	N	1.50	20	70	10	30	N	30	20
S119	73AF024	2000	.5	N	1.00	20	30	20	20	L	30	30
S120	73BC220	1000	N	N	1.00	30	500	30	20	N	100	10
S121	73BC217	1000	N	N	L	20	500	20	30	N	100	L
S122	73DG111	1000	2.0	N	1.00	15	150	5	70	N	20	10
S123	73BC242	1000	N	N	L	50	2000	5	20	N	1000	L
S124	73BC241	1000	N	N	1.00	30	1000	10	100	N	1000	10
S125	73DG147	1000	2.0	N	1.00	15	70	10	100	N	30	10
S126	73BC223	2000	2.0	N	1.00	30	70	100	50	10	15	15
S127	73BC246	1500	1.0	N	1.00	15	150	20	30	N	30	15
S128	73BC247	1000	N	N	1.50	15	70	5	30	7	15	20
S129	73AF029	1000	N	500	1.50	20	50	15	30	N	20	15
S130	73AF032	2000	N	300	1.00	30	100	15	50	N	50	20
S131	73DG161	1500	N	N	1.00	20	150	20	100	7	30	100
[3]S132	73DG163	5000	N	2000	30.00	30	20	5	L	10	30	10
S133	73DG171	1000	N	N	1.00	20	100	20	20	N	30	10
S134	74DG086	1000	N	N	L	20	70	150	N	N	20	10
S135	73DG169	1000	N	N	L	20	150	10	L	N	30	10
S136	73AF048	1000	N	N	1.00	15	20	5	30	20	5	15
S137	73AF042	1000	N	N	1.00	15	50	L	100	N	10	10
S138	73BC260	1000	N	N	1.00	15	50	L	150	N	10	15

[3]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.—Continued

Sample number	Semiquantitative spectrographic analyses--Continued						Atomic absorption				
	Sc (5)	Sn (10)	Sr (100)	V (10)	Y (10)	Zr (10)	Au (0.1)	Cu (5)	Hg (2)	Pb (5)	Zn (10)
S071	30	N	500	200	30	100	N	120	0.06	15	65
S072	20	10	300	200	20	500	N	L	.45	5	10
S073	15	N	300	100	30	200	N	20	.24	50	120
S074	15	N	300	200	30	150	N	20	.26	30	80
S075	20	N	300	200	30	150	N	85	.10	35	100
S076	10	N	150	100	30	200	N	50	.12	40	40
S077	15	50	300	300	50	500	N	10	.12	40	25
S078	15	N	300	150	20	150	.15	35	.04	10	100
S079	10	N	500	200	20	100	N	45	.06	15	130
S080	20	N	150	200	30	150	N	70	.24	20	150
S081	20	N	200	200	30	50	B	75	.08	15	60
S082	20	N	200	150	30	70	.40	10	.04	5	30
S083	20	N	200	150	30	50	B	30	.18	220	550
S084	30	N	200	200	20	50	N	65	.10	50	130
S085	20	N	150	200	30	100	N	50	.20	30	110
S086	15	N	200	300	50	150	N	95	.20	40	400
S087	20	N	700	150	20	100	N	50	.04	10	45
S088	70	N	1000	150	70	150	N	70	.04	10	45
S089	50	N	300	150	30	150	N	80	.08	15	50
S090	30	N	700	150	30	150	N	70	.10	15	55
S091	50	N	1000	150	70	150	N	70	.04	10	35
S092	30	N	700	150	50	150	N	35	.04	5	45
S093	30	N	700	150	30	150	N	55	.04	10	45
S094	30	N	150	200	30	70	N	110	.10	10	75
S095	50	N	500	300	20	150	N	30	.06	10	240
S096	30	N	300	150	50	100	N	40	.45	10	210
S097	50	N	700	500	50	150	N	45	.02	5	120
S098	70	N	700	300	60	70	N	50	.04	5	60
S099	30	N	700	500	70	150	N	20	.04	15	[4]140
S100	20	N	150	150	50	70	N	60	.06	20	100
S101	30	N	500	500	50	150	N	40	.02	10	[4]120
S102	70	N	300	500	20	50	N	200	.06	5	60
S103	50	N	300	500	15	50	N	100	.04	10	95
S104	50	N	500	500	70	100	N	110	.02	10	140
S105	70	N	500	300	50	70	N	50	.40	10	65
S106	70	N	500	500	30	70	N	85	.04	10	75
S107	70	N	300	500	20	50	N	230	.02	5	40
S108	70	N	700	500	70	100	N	55	.08	10	55
S109	30	N	150	200	30	50	N	190	N	10	65
S110	20	N	200	100	15	50	N	55	.02	20	100
S111	50	N	300	200	30	100	N	50	.06	10	65
S112	20	N	200	150	20	70	N	50	.02	10	65
S113	50	N	100	150	15	50	.10	120	.02	10	90
S114	50	N	100	200	20	50	L	75	.80	40	270
S115	50	N	200	200	30	50	.70	100	.28	10	120
S116	15	N	100	150	30	70	.30	100	.40	10	280
S117	30	N	150	150	30	100	.10	60	.04	15	140
S118	15	N	200	100	15	150	.40	25	.10	15	85
S119	20	N	200	150	20	100	N	50	.04	40	240
S120	30	N	200	200	30	50	N	45	.04	5	50
S121	30	N	200	200	30	150	N	45	.02	L	60
S122	20	N	300	150	30	200	N	20	N	L	25
S123	20	N	150	100	20	150	N	20	.02	10	40
S124	20	N	200	150	20	70	N	25	.02	20	50
S124	20	N	500	200	30	300	N	20	N	L	25
S126	50	N	300	200	50	500	N	15	N	10	90
S127	20	L	500	200	30	200	N	35	.04	15	50
S128	20	10	150	200	30	500	N	20	.04	10	50
S129	10	N	200	100	15	70	N	30	.20	15	55
S130	20	N	150	150	20	70	N	45	.08	25	190
S131	20	20	300	150	50	200	L	60	N	30	60
S132	15	N	500	30	15	50	N	50	N	15	60
S133	20	N	200	200	20	100	.10	65	N	10	60
S134	50	N	200	200	30	70	N	110	N	5	55
S135	30	N	300	200	20	70	N	50	N	100	35
S136	20	N	500	200	30	500	N	15	N	5	30
S137	30	10	500	150	30	100	N	15	N	5	30
S138	30	10	500	150	50	200	N	10	N	5	20

[4]Spectrographic analysis indicates 300 ppm.

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 (Tgr)----------------			X	
Migmatite associated with Tertiary granodiorite (Tmg)		X		
Biotite-quartz-feldspar gneiss in gneiss domes (TKgn)		X		
Porphyritic garnet-biotite-hornblende diorite (Kgd)--			X	
Foliated biotite-hornblende tonalite (Kto)-----------			X	
Gneiss and schist of Coast plutonic complex (Kgs)----		X		
Marble and calc-silicate gneiss of Coast plutonic complex (Kmb).		X		
Hornblende schist and amphibolite (Khs)---------------	X			
Biotite schist (Kbs)----------------------------------	X			
Undivided ultramafic rocks (Kum)----------------------				X
Greenschist and greenstone (Kgs)----------------------	X			
Phyllite and slate (Kp)-------------------------------	X			
Limestone (Kls)---------------------------------------	X			

TABLE 7.—*Levels of anomality for selected metals in bedrock geochemical samples as used on plate 2 and figures 9 to 22*

Element	Anomalous at or above (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]	.05	.05	.05	.05
Cu[2]	1000	100	300	300
Hg[3]	.1	.1	.1	.15
Pb[2]	50	30	30	50
Zn[2]	200	200	200	300

[1]See table 6 for correlations of these geochemical units with the lithologic units used elsewhere in this report.

[2]Analyses by atomic absorption, all others except Hg by semiquantitative spectrographic method.

[3]Analysis by instrumentation method.

TABLE 8.—*Anomalous bedrock geochemical samples collected by the Geological Survey in the Tracy Arm-Fords Terror wilderness study area, Alaska*

Sample number	Field number	Values in percent				Values in parts per million													
		Fe	Mg	Ca	Ti	Mn	Ag	As	Au	B	Ba	Be	Bi	Cd	Co	Cr	Cu	La	Mo
R001	75AF095A	10.0	3.00	10.00	0.500	1500	N	N	N	100	100	N	N	N	150	700	100	N	N
R001	75AF095B	7.0	3.00	7.00	.700	1500	N	N	N	L	50	N	N	N	50	70	150	N	N
R002	75DB074A	10.0	5.00	7.00	.700	1500	N	N	N	L	150	N	N	N	50	300	70	N	N
R002	75DB074B	7.0	3.00	7.00	.700	1500	N	N	N	10	200	N	N	N	50	L	300	N	N
R002	75DB074C	15.0	3.00	7.00	1.000	2000	L	N	N	15	150	N	N	N	50	L	300	N	N
R003	75DG072C	7.0	7.00	7.00	.200	2000	N	N	N	L	2000	1.0	N	N	50	1500	30	N	N
R004	75BJ032B	7.0	3.00	5.00	.700	1500	N	N	N	10	1500	1.0	N	N	30	200	30	20	N
R005	75BJ026B	5.0	1.50	5.00	1.000	1500	1.5	N	N	L	2000	2.0	N	N	20	20	7	150	N
R006	75DB104A	3.0	1.50	5.00	.150	1000	N	N	N	L	2000	1.5	N	N	5	L	L	20	N
R007	74AF057A	7.0	2.00	5.00	.500	1500	N	N	N	N	1500	L	N	N	15	10	L	N	N
R008	75DG086A	10.0	2.00	7.00	.700	1500	N	N	N	L	1500	1.0	N	N	20	100	7	50	N
R009	75BJ041A	2.0	1.50	7.00	.200	700	N	N	N	N	>5000	L	100	N	5	300	50	20	50
R010	75BJ006A	3.0	1.00	1.50	.200	700	N	N	N	N	1500	5.0	N	N	5	L	7	200	N
R011	75DG151A	10.0	>10.00	.05	.002	700	N	N	N	L	L	N	N	N	100	5000	N	N	N
R012	75DB063B	10.0	>10.00	.05	.005	1000	N	N	N	L	L	N	N	N	150	5000	L	N	N
R012	75DB063C	5.0	>10.00	20.00	.070	1000	N	N	N	L	L	N	N	N	30	>5000	L	N	N
R013	75BJ004B	10.0	>10.00	2.00	.050	1000	N	N	N	10	L	N	N	N	150	3000	30	N	N
R014	75DB065D	20.0	7.00	7.00	.100	1500	5.0	N	N	50	L	N	N	N	20	L	700	N	N
R015	75DB066A	7.0	3.00	5.00	.700	1000	N	N	N	L	1500	1.0	N	N	15	50	15	20	70
R016	75CN020A	3.0	1.00	1.50	.200	500	N	N	N	10	1000	1.0	N	N	15	70	10	30	N
R017	75DB072C	20.0	3.00	10.00	.150	1500	7.0	N	N	70	100	L	N	N	150	70	1000	N	N
R018	75DG048A	1.5	.30	1.00	.070	700	N	N	N	N	1000	5.0	N	N	5	L	L	N	N
R019	75DB059A	5.0	2.00	.70	.300	1500	N	N	N	50	1000	1.5	N	N	20	150	50	70	N
R020	75CC017A	5.0	2.00	2.00	.500	700	L	N	N	L	500	L	N	N	20	150	100	30	N
R021	75AF040A	5.0	1.50	1.50	.300	700	N	N	N	10	200	1.5	N	N	20	150	30	70	N
R022	75DB048C	1.5	.70	2.00	.150	500	.5	N	N	L	>5000	L	N	N	N	100	30	50	30
R023	74DB086B	.3	.02	.15	.020	70	.5	N	N	N	200	1.0	N	N	N	N	L	N	N
R024	74DB084A	3.0	.70	1.00	.150	700	N	N	N	N	1500	L	N	N	L	N	20	N	300
R025	75BJ044A	7.0	10.00	20.00	.150	1500	N	N	N	L	70	N	N	N	50	700	5	N	N
R026	75CN060A	20.0	2.00	5.00	.010	1500	10.0	N	N	70	100	L	N	N	70	L	1000	N	N
R027	75DG004A	3.0	1.50	1.00	.500	1000	N	N	N	L	700	1.0	N	N	15	100	20	70	N
R027	75DG004B	2.0	.50	1.00	.150	500	N	N	N	10	700	1.0	N	N	5	50	15	20	N
R027	75DG004D	5.0	1.50	1.00	.500	500	N	N	N	L	2000	2.0	N	N	7	150	30	100	N
R028	75DB127A	7.0	2.00	5.00	.700	1000	2.0	N	N	L	3000	1.5	N	N	5	200	70	100	N
R028	75DB127B	1.0	.50	5.00	.100	200	N	N	N	N	500	1.0	N	N	5	300	10	L	30
R028	75DB127D	.2	>10.00	>20.00	.020	300	N	N	N	20	3000	N	N	N	N	L	N	N	N
R029	75DG002A	3.0	.70	1.50	.150	700	N	N	N	L	1000	1.0	N	N	7	L	L	30	N
R029	75DG002B	5.0	1.50	2.00	.500	700	N	N	N	L	1500	1.0	N	N	20	70	20	50	N
R030	75DB027A	1.5	.70	1.50	.150	700	3.0	N	N	10	1000	1.5	N	N	L	L	L	20	N
R031	75CN016B	.7	.10	2.00	.030	50	L	N	N	L	>5000	5.0	N	N	L	L	30	N	5

R032	74DG364A	7.0	2.00	7.00	.500	1500	N	N	N	N	>5000	N	N	N	30	200	30	N	N
R033	74CN235C	7.0	5.00	5.00	1.000	1000	N	N	N	N	300	L	N	N	70	300	30	N	N
R034	75CN044C	5.0	1.50	3.00	.300	1500	2.0	N	N	10	1500	L	N	N	15	L	50	L	N
R035	74CN221C	3.0	1.50	3.00	.200	700	N	N	N	L	700	1.0	N	N	10	100	100	20	50
R036	74CN220A	7.0	1.50	3.00	.500	1000	N	N	N	N	1500	L	N	N	20	50	15	30	N
R036	74CN220B	7.0	3.00	5.00	.700	1000	N	N	N	N	700	L	N	N	30	200	15	20	N
R037	74CC149A	7.0	2.00	3.00	.700	1500	N	N	N	L	1500	L	N	N	50	30	70	N	N
R038	74CC146B	10.0	3.00	5.00	.700	1500	N	N	N	N	700	N	N	N	70	1000	15	N	N
R039	74CN182A	7.0	2.00	3.00	.500	700	N	N	N	N	1500	1.5	N	N	50	300	20	20	N
R040	74CN183E	5.0	1.50	1.50	.500	1000	N	N	N	N	1000	1.0	N	N	15	30	70	30	N
R040	74CN183F	3.0	1.50	.50	.300	200	N	N	N	N	1500	L	N	N	5	300	50	20	N
R041	74CC151C	.2	.70	>20.00	.020	30	N	N	N	N	N	N	N	N	N	L	N	N	N
R042	74CN248A	3.0	.70	1.50	.150	300	N	N	N	N	1500	1.0	N	N	5	L	L	N	N
R043	74CN249B	7.0	3.00	3.00	.700	1000	N	N	N	N	200	N	N	N	70	1000	15	20	N
R043	74CN249C	10.0	3.00	2.00	.700	700	N	N	N	N	700	L	N	N	50	300	150	30	N
R044	74CN251A	10.0	2.00	.30	.500	500	10.0	N	N	N	2000	1.5	N	N	7	200	70	150	N
R045	74DB390B	3.0	1.50	.70	.500	500	1.5	N	N	L	>5000	1.5	N	N	5	150	30	50	N
R046	74DB437A	.2	5.00	>20.00	.030	150	N	N	N	N	20	N	N	N	N	L	N	N	N
R047	74DB396B	10.0	1.00	7.00	.030	1500	1.0	N	N	30	70	L	N	N	10	L	150	L	N
R048	74DB397A	.2	>10.00	20.00	.030	100	N	N	N	N	N	N	N	N	N	L	L	N	N
R049	74WV344B	5.0	1.00	.50	.700	500	N	N	N	L	1500	2.0	N	N	20	300	50	70	N
R050	74WV019B	7.0	2.00	2.00	.700	700	N	N	N	N	1000	L	N	N	15	100	20	50	N
R050	74WV019C	.5	.03	.15	.030	200	N	N	N	N	300	1.0	N	N	L	L	L	N	30
R051	74CC220A	2.0	.70	1.50	.150	500	N	N	N	N	1500	1.5	N	N	5	L	N	20	N
R052	74DG331A	5.0	1.50	3.00	.200	1000	N	N	N	N	1500	L	N	N	7	20	L	L	N
R053	74CN207A	5.0	1.50	3.00	.200	700	N	N	N	N	1500	1.0	N	N	10	L	5	100	N
R054	74CN210A	1.5	.70	.30	.200	700	N	N	N	N	1000	L	N	N	5	20	L	20	N
R055	74CC171A	.5	.50	1.50	.150	70	L	N	N	N	>5000	L	N	N	5	100	30	N	N
R056	74WV292B	15.0	7.00	10.00	1.000	1500	N	N	N	L	100	N	N	N	70	1500	70	N	N
R057	74WV291E	15.0	7.00	10.00	1.000	1500	N	N	N	N	200	L	N	N	70	1000	150	L	N
R058	74DB355A	.5	7.00	20.00	.020	150	N	N	N	N	N	N	N	N	L	L	L	N	N
R059	74DB354C	.2	1.50	20.00	.015	50	N	N	N	N	300	L	N	N	N	L	5	N	N
R060	74DB345B	5.0	2.00	1.00	.700	500	N	N	N	15	1000	1.0	N	N	5	300	50	100	30
R061	74DB344D	5.0	1.50	1.00	.500	300	N	N	N	N	1500	L	N	N	10	300	100	100	70
R062	74DB347D	3.0	1.50	1.00	.500	700	N	N	N	L	1500	2.0	N	N	5	100	20	N	30
R063	74WV248A	3.0	3.00	1.50	.500	1500	N	N	N	N	500	L	N	N	30	700	30	N	N
R064	74DB369D	10.0	2.00	15.00	.100	>5000	N	N	N	N	N	L	N	N	10	L	L	N	N
R065	74DB370A	7.0	3.00	5.00	.500	1500	N	N	N	N	1000	L	N	N	20	300	15	20	50
R065	74DB370D	7.0	7.00	3.00	.300	1500	N	N	N	N	700	N	N	N	70	1000	10	N	N
R066	74DB373F	7.0	7.00	.70	.005	1000	N	N	N	N	20	N	N	N	70	3000	20	N	N
R067	74DB308B	7.0	3.00	5.00	.300	1500	N	N	N	L	1000	L	N	N	30	50	150	N	L
R068	74CC118A	3.0	1.00	1.50	.300	200	N	N	N	N	1500	1.5	N	N	10	150	50	N	N
R069	74CC154A	7.0	3.00	2.00	.500	1000	N	N	N	N	500	L	N	N	70	1000	50	N	N
R070	74DG322A	3.0	5.00	10.00	0.100	700	N	N	N	N	70	N	N	N	20	1500	L	N	N
R071	74CN189A	.7	.50	1.50	.150	70	L	N	N	N	>5000	L	N	N	5	150	30	N	50
R072	74DG312A	3.0	.70	.50	.150	300	N	N	N	L	3000	L	N	N	5	20	L	70	N
R073	74CN201A	7.0	.30	7.00	.700	700	N	N	N	N	300	1.0	N	N	20	200	20	100	N
R073	74CN201B	5.0	2.00	1.50	.200	500	N	N	N	N	500	L	N	N	10	150	15	30	N

TABLE 8.—Continued

Sample number	Values in parts per million--Continued																Bedrock geo-chemical unit
													Instrumental	Atomic absorption			
	Nb	Ni	Pb	Sb	Sc	Sn	Sr	V	W	Y	Zn	Zr	Hg	Au	Cu	Pb	Zn	
R001	N	200	N	N	70	N	100	200	N	30	N	70	0.02	N	55	10	10	GR
R001	N	70	N	N	70	N	100	300	N	30	N	70	.02	N	120	5	5	GR
R002	N	100	L	N	50	N	100	300	N	30	N	70	.12	N	80	5	10	GN
R002	N	50	10	N	50	N	100	300	N	50	N	100	.04	N	460	L	15	GN
R002	N	15	20	N	70	N	L	500	N	70	N	150	.04	N	310	15	10	GN
R003	N	150	15	N	50	N	700	200	N	20	N	20	L	N	20	5	10	GN
R004	N	70	50	N	30	N	1500	200	N	30	N	50	L	N	20	5	35	GR
R005	N	15	30	N	15	N	2000	150	N	30	N	200	.02	N	L	5	30	GN
R006	N	5	50	N	10	N	1000	100	N	15	N	100	L	1.00	L	L	30	GR
R007	N	5	20	N	20	N	700	150	N	30	N	50	.10	N	L	5	35	GN
R008	20	70	15	N	30	N	1000	200	N	100	N	10	.02	N	L	5	35	GR
R009	N	50	10	N	15	N	300	2000	N	70	N	150	.02	N	25	5	15	GN
R010	L	L	30	N	5	N	100	20	N	50	N	200	.02	N	5	5	40	GN
R011	N	2000	N	N	N	N	N	10	N	L	N	N	.02	N	L	25	20	UM
R012	N	2000	N	N	5	N	N	10	N	N	N	N	.04	N	L	20	20	UM
R012	N	200	N	N	100	N	N	150	N	N	N	N	.02	N	L	L	L	UM
R013	N	3000	N	N	15	N	N	30	N	N	N	N	N	N	15	20	45	GN
R014	N	5	N	N	N	N	N	70	N	L	L	N	.02	N	410	L	5	GN
R015	N	7	20	N	15	N	700	150	N	20	N	70	.06	N	5	L	25	GN
R016	N	20	30	N	10	N	200	70	N	10	N	200	.10	N	15	10	45	GR
R017	N	200	N	N	10	N	100	150	N	20	300	20	.04	N	870	10	55	GN
R018	L	N	50	N	10	N	100	15	N	70	N	100	.04	N	N	5	25	GR
R019	N	70	50	N	15	N	100	150	N	20	N	150	.12	N	45	10	45	GN
R020	N	70	10	N	15	N	100	100	N	20	N	150	.04	N	95	15	65	GR
R021	N	70	20	N	15	N	100	100	N	30	N	200	.02	N	15	10	30	GR
R022	N	15	15	N	7	N	100	500	N	20	L	70	.02	N	20	5	35	GN
R023	L	L	70	N	N	N	N	15	N	30	N	100	.02	N	L	45	20	GR
R024	N	L	50	N	7	N	500	30	N	10	N	70	N	N	40	10	65	GR
R025	N	100	N	N	70	N	150	200	N	10	N	10	L	N	L	L	20	GR
R026	N	20	N	N	L	N	N	50	100	10	N	L	.06	N	1100	5	70	GN
R027	L	20	30	N	15	N	200	150	N	30	N	150	.18	N	20	5	60	GN
R027	N	7	30	N	7	N	200	50	N	15	N	150	.12	N	15	L	30	GN
R027	L	7	30	N	20	N	300	150	N	70	N	150	.14	N	30	5	80	GN
R028	20	30	50	N	50	N	200	150	N	50	N	200	.04	N	45	30	100	GN
R028	N	70	10	N	5	N	200	500	N	50	N	100	.02	N	20	15	30	GN
R028	N	5	L	N	N	N	300	70	N	L	N	10	.02	N	10	50H	15	GN
R029	N	L	30	N	7	N	700	70	N	15	N	100	.18	N	N	L	40	GR
R029	L	20	10	N	15	N	700	150	N	20	N	150	.18	N	L	L	5	GR
R030	N	L	30	N	7	N	500	50	N	10	N	100	.04	N	N	5	45	GR
R031	20	10	30	N	L	N	300	70	N	30	N	30	.04	N	35	5	L	GN

R032	N	70	L	N	30	N	300	150	N	20	N	70	N	N	25	15H	25	GR
R033	N	70	10	N	70	N	300	300	N	30	N	50	.02	N	25	.10	40	GR
R034	N	10	200	N	15	N	300	150	N	20	300	150	.04	N	50	130	230	GN
R035	N	20	L	N	20	N	200	700	N	70	N	100	.02	N	80	10	35	GN
R036	N	20	10	N	30	N	300	150	N	50	N	200	.16	N	10	10	40	GN
R036	N	70	15	N	30	N	300	200	N	70	N	200	.12	N	10	5	20	GN
R037	N	70	L	N	30	N	700	200	N	20	N	30	.02	N	25	L	20	GR
R038	N	300	L	N	50	N	200	150	N	10	N	70	L	N	15	5	40	GR
R039	N	100	10	N	30	N	700	150	N	20	N	100	.04	N	20	5	35	GR
R040	N	100	N	N	30	N	150	200	N	30	300	30	.06	N	110	15	390	GR
R040	N	30	L	N	20	N	200	200	N	15	L	150	.02	N	35	10	100	GR
R041	N	N	N	N	N	N	700	L	N	10	N	L	.02	N	10	70H	15	GN
R042	N	5	10	N	5	N	500	30	N	L	N	100	.40	N	L	10	35	GR
R043	L	100	10	N	30	N	300	150	N	20	N	100	.06	N	10	10	30	GR
R043	20	30	L	N	30	N	500	150	N	30	N	150	.04	.10	120	10	70	GN
R044	N	7	30	N	30	N	150	150	N	30	N	150	.06	N	55	10	60	GN
R045	N	5	20	N	15	N	200	150	N	50	N	160	N	N	30	10	35	GN
R046	N	N	N	N	N	N	1500	L	N	N	L	L	L	N	5	30	L	GN
R047	N	L	N	N	N	N	N	30	N	N	200	10	.04	N	460	10	50	GN
R048	N	N	N	N	N	N	N	L	N	N	N	L	L	N	5	30	L	GN
R049	L	30	10	N	30	N	100	100	N	50	N	200	.02	N	30	10	65	GR
R050	L	50	10	N	15	N	700	150	N	30	L	150	.28	N	25	15	80	GR
R050	N	5	30	N	L	N	N	10	N	N	N	50	N	N	N	10	5	GR
R051	N	5	15	N	5	N	500	50	N	N	N	100	.04	.10	N	5	40	GR
R052	N	5	10	N	15	N	500	100	N	30	N	150	.12	N	15	10	70	GR
R053	N	5	10	N	15	N	700	100	N	20	N	70	.14	N	L	5	30	GR
R054	L	10	L	N	5	N	N	20	N	15	N	200	.06	N	N	30	15	GN
R055	N	100	N	N	7	N	L	200	N	30	300	70	.06	N	40	10	270	GN
R056	20	200	N	N	70	N	150	200	N	20	N	150	L	N	35	L	5	GN
R057	L	300	N	N	30	N	100	200	N	20	N	150	L	N	80	5	15	GN
R058	N	L	N	N	N	N	150	10	N	N	N	N	L	N	10	30H	5	GN
R059	N	L	N	N	N	N	150	15	N	L	N	N	N	N	10	30H	5	GN
R060	N	20	50	N	30	N	200	150	N	70	N	200	.02	N	45	5	60	GN
R061	N	50	15	N	20	N	150	150	N	50	N	150	N	N	55	5	170	GN
R062	N	15	L	N	20	N	100	150	N	15	N	100	N	L	30	5	50	GN
R063	N	500	N	N	30	N	L	150	N	15	N	50	N	L	20	10	45	GN
R064	N	10	N	N	N	70	N	70	N	15	200	50	N	L	L	5	15	GN
R065	L	100	L	N	30	N	700	150	N	30	N	100	N	L	15	5	40	GN
R065	N	300	L	N	30	N	200	100	N	15	N	70	N	N	10	10	50	GN
R066	N	3000	N	N	7	N	N	50	N	N	N	N	N	N	15	L	5	UM
R067	N	30	10	N	50	N	200	300	N	50	500	70	.02	N	190	5	370	GN
R068	N	50	L	N	15	N	300	200	N	20	300	100	.06	N	65	10	210	GN
R069	N	300	N	N	30	N	200	150	N	15	N	50	N	N	30	5	30	GN
R070	N	150	L	N	30	N	150	100	N	10	N	10	0.04	N	15	10	10	GN
R071	N	20	N	N	7	N	150	1500	N	30	N	70	.02	N	35	5	190	GN
R072	N	5	20	N	5	N	300	20	N	10	N	50	.10	N	15	5	50	GR
R073	L	50	20	N	30	N	500	150	N	50	N	200	.14	N	10	15	50	GN
R073	N	15	30	N	20	N	300	100	N	15	N	100	.14	N	15	10	40	GN

TABLE 8.—Continued

Sample number	Field number	Values in percent--Continued				Values in parts per million--Continued													
		Fe	Mg	Ca	Ti	Mn	Ag	As	Au	B	Ba	Be	Bi	Cd	Co	Cr	Cu	La	Mo
R074	74CC161B	7.0	2.00	3.00	.300	2000	N	N	N	L	1500	1.0	N	N	50	700	7	N	N
R074	74CC161C	7.0	3.00	5.00	.500	1500	N	N	N	L	500	L	N	N	50	1000	N	N	N
R075	73DB232A	10.0	3.00	7.00	>1.000	1500	N	N	N	10	150	1.0	N	N	100	50	30	70	N
R076	74DG329C	5.0	2.00	1.00	.500	1000	N	N	N	N	3000	L	N	N	20	200	L	300	N
R077	74DB415A	5.0	3.00	7.00	.200	1500	N	N	N	L	1500	1.0	N	N	15	20	L	30	N
R078	74DG390A	5.0	1.00	.05	.200	100	2.0	N	N	15	5000	1.0	N	N	5	L	50	20	N
R079	74DB333B	7.0	1.00	1.50	.100	200	N	N	N	N	500	N	N	N	5	200	100	L	30
R080	74DB332C	2.0	.50	.05	.150	30	15.0	N	N	N	>5000	1.5	N	N	5	L	100	L	N
R081	73AF285B	3.0	.70	.30	.150	200	10.0	N	N	L	500	L	20	N	N	L	5000	L	N
R082	73DG378B	3.0	.50	.20	.150	100	2.0	N	N	10	1500	1.0	N	30	10	20	150	L	30
R083	73BC400A	5.0	2.00	2.00	.500	700	.7	N	N	L	1000	1.0	N	N	20	50	100	20	10
R084	73BC398A	5.0	7.00	3.00	1.000	2000	N	N	N	N	20	1.0	N	N	50	1500	10	N	N
R085	73DG397A	5.0	3.00	3.00	.500	1500	N	N	N	L	1500	1.5	N	N	20	30	10	50	N
R086	73DG394A	5.0	2.00	2.00	.500	1000	N	N	N	L	1500	1.0	N	N	20	20	10	70	20
R087	73BC404A	3.0	2.00	3.00	.500	700	2.0	N	N	L	1000	1.0	N	N	15	15	20	L	N
R088	74CC139G	1.0	3.00	5.00	.070	150	N	N	N	30	500	200.0	N	N	5	L	5	L	N
R089	74CC138A	5.0	1.00	2.00	.500	700	N	N	N	L	700	1.0	N	N	20	20	30	N	N
R090	73AF271A	3.0	7.0	3.00	.050	700	N	N	N	N	L	N	N	N	50	5000	L	N	N
R090	73AF271B	7.0	10.00	.20	.005	1000	N	N	N	N	L	N	N	N	200	>5000	20	N	N
R091	73DB239A	5.0	10.00	2.00	.100	1000	N	N	N	L	L	L	N	N	100	>5000	10	N	N
R091	73DB239B	7.0	10.00	.15	.002	1000	N	N	N	L	L	N	N	N	200	>5000	20	N	N
R091	73DB239C	5.0	10.00	.30	.020	1000	N	N	N	L	150	N	N	N	150	>5000	L	N	N
R091	73DB239D	3.0	10.00	5.00	.050	500	.5	N	N	L	L	N	N	N	100	>5000	5	N	N
R091	73DB239E	5.0	10.00	.07	.010	700	N	N	N	L	L	N	N	N	150	>5000	L	N	N
R092	74DB447C	7.0	>10.00	.15	.020	700	N	N	N	L	20	N	N	N	100	>5000	L	N	N
R093	74DB446B	7.0	>10.00	1.50	.100	500	N	N	N	L	20	N	N	N	100	>5000	50	N	N
R093	74DB446C	2.0	>10.00	10.00	.070	1000	N	N	N	N	20	N	N	N	30	1500	30	N	N
R093	74DB446E	2.0	7.00	10.00	.070	300	N	N	N	N	20	N	N	N	15	1500	30	N	N
R094	74DG314A	1.5	.70	1.00	.150	300	N	N	N	N	1500	L	N	N	L	20	L	20	N
R095	74DG319A	1.5	.30	.50	.070	300	N	N	N	N	700	L	N	N	5	L	L	150	N
R096	74DG318C	1.0	.30	.70	.070	300	N	N	N	N	1000	L	N	N	5	L	L	L	N
R097	74DG317B	7.0	7.00	3.00	.150	1000	N	N	N	N	1000	L	N	N	70	2000	7	N	N
R098	74DG315A	3.0	7.00	.20	.015	700	N	N	N	N	N	N	N	N	70	1500	20	N	N
R099	73AF281A	3.0	1.50	1.50	.500	1000	N	N	N	N	1500	1.0	N	N	10	N	10	70	15
R100	73DB242B	3.0	10.00	7.00	.030	1000	N	N	N	L	L	L	N	N	50	5000	5	N	N
R100	73DB242C	3.0	10.00	7.00	.030	1000	N	N	N	L	L	L	N	N	50	5000	L	N	N
R100	73DB242E	3.0	10.00	1.00	.020	700	N	N	N	L	20	N	N	N	100	>5000	10	N	N
R101	73DG406B	5.0	10.00	1.00	.020	1000	N	N	N	N	L	N	N	N	100	3000	50	N	N
R101	73DG406A	3.0	5.00	10.00	.050	700	N	N	N	L	L	N	N	N	20	200	10	N	N
R102	73DG407B	5.0	10.00	.05	.010	700	N	N	N	N	L	N	N	N	100	5000	L	N	N

R103	73DB247A	3.0	5.00	7.00	.150	100	N	N	N	L	100	L	N	N	50	1500	10	L	N
R104	74DG346A	5.0	3.00	5.00	.300	1000	N	N	N	N	700	1.0	N	N	15	70	15	N	N
R105	74WV256A	7.0	>10.00	.05	.010	1000	N	N	N	N	30	N	N	N	100	5000	L	N	N
R106	74AF154A	5.0	1.00	3.00	.300	500	N	N	N	N	3000	L	N	N	5	L	7	L	N
R107	74DG349A	1.0	.20	.70	.150	700	N	N	N	N	1500	1.0	N	N	5	L	N	70	N
R108	74DG350A	2.0	.70	1.50	.150	500	N	N	N	N	500	1.0	N	N	5	L	L	30	N
R109	74DG351B	20.0	5.00	5.00	1.000	1500	L	N	N	N	300	N	N	N	100	50	300	N	N
R109	74DG351C	10.0	3.00	15.00	.700	1000	N	N	N	N	700	L	N	N	30	30	30	70	N
R110	74DG360B	10.0	7.00	7.00	>1.000	1500	N	N	N	N	70	L	N	N	100	1500	7	N	N
R111	74DB340D	5.0	1.50	2.00	.500	700	20.0	N	N	N	700	1.0	N	N	30	150	150	N	N
R112	74CN193B	2.0	.50	.20	.100	1500	N	N	N	L	150	L	N	N	5	L	70	L	N
R113	74AF237A	5.0	3.00	5.00	.150	1000	N	N	N	N	300	1.0	N	N	50	300	20	N	N
R114	74AF236A	1.5	.30	.50	.150	200	N	N	N	L	1500	2.0	N	N	5	20	5	20	N
R115	74AF235A	10.0	2.00	2.00	.300	700	N	N	N	N	2000	L	N	N	50	200	30	100	N
R116	74CC099B	7.0	3.00	5.00	.500	1000	N	N	N	N	500	N	N	N	50	700	50	L	N
R117	74CN149B	10.0	3.00	3.00	.500	1500	N	N	N	N	700	L	N	N	70	700	15	N	N
R118	74CN236B	.7	.10	.30	.020	70	N	N	N	N	1000	5.0	N	N	L	20	5	N	10
R119	74CN168D	15.0	3.00	3.00	.700	500	N	N	N	N	150	N	N	N	100	100	150	20	N
R120	74DB408B	7.0	>10.00	5.00	.150	1500	N	N	N	L	300	N	N	N	70	1500	L	N	N
R121	74DB406B	5.0	3.00	7.00	.200	1500	N	N	N	L	500	L	N	N	20	L	70	N	100
R121	74DB406C	7.0	3.00	5.00	.150	1500	N	N	N	L	200	L	N	N	30	L	150	N	N
R122	74WV251C	7.0	3.00	3.00	.500	1000	N	N	N	N	500	L	N	N	70	1000	30	N	N
R123	74DB222C	7.0	1.50	3.00	.300	1500	L	N	N	N	300	L	N	N	30	L	700	N	N
R124	74CN151D	3.0	1.00	5.00	.200	700	N	N	N	N	150	5.0	N	N	5	30	7	L	N
R125	74CN152B	7.0	3.00	3.00	.500	1500	N	N	N	N	700	1.5	N	N	50	700	L	N	N
R126	74CN153C	5.0	1.00	.50	.500	300	N	N	N	10	700	1.0	N	N	5	100	30	30	N
R127	74CN093A	15.0	7.00	10.00	.500	1500	N	N	N	15	100	N	N	N	100	500	50	N	N
R128	74CN088A	10.0	3.00	7.00	.500	1500	N	N	N	L	1000	N	N	N	30	L	15	N	N
R128	74CN088C	5.0	.70	2.00	.200	700	7.0	N	N	N	>5000	1.0	N	N	L	15	L	150	N
R129	74DG232A	1.5	1.00	2.00	.200	200	.7	N	N	L	>5000	1.0	N	100	7	300	70	N	30
R130	74CC062C	L	.10	7.00	.005	20	N	N	N	N	N	N	N	N	5	L	L	N	N
R131	74WV165A	.1	.70	20.00	.010	100	N	N	N	N	50	N	N	N	N	L	N	N	N
R132	74CC093C	3.0	1.00	1.50	.300	700	N	N	N	N	1500	3.0	N	N	10	L	10	70	N
R133	74CN138E	10.0	1.50	5.00	.700	2000	N	N	N	10	700	1.0	N	N	70	1000	L	N	N
R134	74CC091A	7.0	1.50	3.00	.700	700	N	N	N	N	500	2.0	N	N	30	70	7	20	N
R134	74CC091C	15.0	3.00	3.00	.700	700	N	N	N	N	700	L	N	N	70	300	50	20	N
R135	74WV200A	3.0	.70	5.00	.150	700	N	N	N	L	500	10.0	N	N	10	20	5	30	N
R136	74AF200A	3.0	.70	2.00	.150	700	N	N	N	N	2000	2.0	N	N	10	20	L	150	N
R137	74AF201A	3.0	.70	2.00	.150	500	N	N	N	N	1500	2.0	N	N	7	L	L	20	N
R138	74DB274B	7.0	>10.00	.30	.005	1500	N	N	N	L	L	N	N	N	100	>5000	L	N	N
R139	73DB220A	5.0	3.00	2.00	.500	700	1.0	N	N	10	3000	1.0	N	N	15	2000	100	20	7
R140	73DB222F	3.0	2.00	10.00	.200	1000	N	N	N	L	1500	L	N	N	50	1500	30	70	N
R141	73DG387A	7.0	3.00	1.50	.500	1500	N	N	N	N	20	L	N	N	30	N	70	L	N
R142	73DG389A	7.0	2.00	.50	.500	500	1.0	N	N	10	3000	1.0	N	N	30	50	200	L	70
R143	73AF256A	2.0	.70	L	.150	100	1.5	N	N	15	1000	1.0	N	N	N	N	10	30	N
R144	73AF254D	3.0	2.00	2.00	.300	1000	.5	N	N	L	1000	1.0	N	N	20	100	100	L	70
R145	74DB296C	7.0	10.00	10.00	0.300	3000	N	N	N	L	N	L	N	N	50	1500	30	N	N
R146	74DB297E	7.0	>10.00	10.00	.150	1500	N	N	N	N	L	N	N	N	50	1500	7	N	N
R147	74AF251A	20.0	7.00	7.00	1.000	1000	N	N	N	10	150	L	N	N	150	700	100	N	N

TABLE 8.—Continued

Sample Number	Values in parts per million--Continued																Bedrock geo-chemical unit
												Instrumental	Atomic absorption				
	Nb	Ni	Pb	Sb	Sc	Sn	Sr	V	W	Y	Zn	Zr	Hg	Au	Cu	Pb	Zn	
R074	N	300	L	N	30	N	200	200	N	30	N	20	.02	N	5	L	5	GN
R074	N	300	L	N	30	N	200	200	N	15	N	20	.02	N	L	5	40	GN
R075	50	50	10	N	50	N	200	300	N	50	N	200	N	N	15	5	25	GN
R076	N	50	30	N	30	N	200	100	N	100	N	200	.22	N	15	10	75	GN
R077	N	L	10	N	15	N	1000	100	N	15	N	100	.02	N	10	130	95	GN
R078	N	L	300	N	30	N	N	20	N	66	N	200	.02	N	55	250	10	SH
R079	N	30	50	N	15	N	200	300	N	10	300	80	.02	N	130	55	170	SH
R080	N	5	1000	N	15	N	N	20	N	20	N	100	.36	N	130	1500	30	SH
R081	N	5	15	N	7	N	100	30	N	10	N	30	.55	.02	5700	10	25	SH
R082	N	200	15	N	10	N	N	1000	N	20	2000	50	N	N	85	15	1600	SH
R083	L	50	15	N	20	N	200	300	N	50	500	150	N	N	50	10	350	SH
R084	N	1000	10	N	30	N	200	150	N	20	N	150	N	N	5	L	10	SH
R085	L	7	30	N	30	N	700	150	N	20	N	50	N	N	10	50	55	GR
R086	L	5	15	N	20	N	700	150	N	20	N	70	N	N	5	10	65	GR
R087	L	5	10	N	15	N	500	150	N	15	N	150	N	N	10	10	55	GR
R088	N	5	20	N	N	20	150	10	N	10	N	150	.02	N	10	10	25	GN
R089	N	10	15	N	30	N	700	150	N	20	N	100	.10	N	25	5	30	GR
R090	N	1000	N	N	30	N	N	70	N	L	N	N	N	N	L	5	5	UM
R090	N	5000	N	N	10	N	N	50	N	N	N	N	N	N	10	25	20	UM
R091	N	3000	L	N	20	N	N	100	N	15	N	N	N	N	10	5	10	UM
R091	N	3000	N	N	10	N	N	30	N	N	N	N	N	N	L	20	25	UM
R091	N	2000	N	N	10	N	N	50	N	N	N	N	N	N	L	15	25	UM
R091	N	2000	N	N	10	N	L	70	N	N	N	20	N	N	L	10	10	UM
R091	N	3000	N	N	10	N	N	30	N	N	N	N	N	N	L	20	20	UM
R092	N	1500	N	N	10	N	N	70	N	N	N	N	L	N	N	15	15	UM
R093	N	500	N	N	30	N	N	70	N	N	N	20	.02	N	40	15	30	UM
R093	N	100	N	N	10	N	150	50	N	N	N	10	.02	N	30	L	L	GN
R093	N	100	N	N	30	N	200	70	N	N	N	10	.02	N	30	5	L	GN
R094	N	L	30	N	5	N	200	15	N	20	N	150	.04	.10	15	L	30	GN
R095	N	5	20	N	L	N	N	L	N	15	N	100	.04	N	15	30	35	GR
R096	N	L	20	N	5	N	200	L	N	10	N	50	.04	N	20	95	35	GN
R097	N	300	L	N	30	N	100	100	N	15	N	30	.02	N	15	5	45	GN
R098	N	1000	N	N	7	N	N	30	N	L	N	10	.02	N	45	L	20	GN
R099	L	L	10	N	20	N	500	150	N	30	200	150	N	N	L	5	90	GR
R100	N	2000	L	N	10	N	N	50	N	N	N	N	N	N	5	L	5	UM
R100	N	2000	L	N	7	N	N	50	N	15	N	N	N	N	N	N	5	UM
R100	N	3000	N	N	10	N	N	50	N	N	N	L	N	N	10	20	30	UM
R101	N	3000	10	N	7	N	N	20	N	N	N	N	N	N	45	30	20	UM
R101	N	300	L	N	5	N	100	20	N	N	N	N	N	N	10	10	5	GN
R102	N	3000	N	N	7	N	N	20	N	N	N	N	N	N	L	15	10	UM

R103	N	200	L	N	30	N	200	150	N	10	N	10	.02	N	15	15	5	GN
R104	N	10	300	N	20	N	700	150	N	15	N	100	.06	N	15	230	400	GR
R105	N	2000	N	N	7	N	N	30	N	L	N	N	N	N	L	10	10	UM
R106	L	L	20	N	5	N	500	70	N	15	N	200	.14	N	5	5	35	GR
R107	N	L	10	N	N	N	200	L	N	10	N	50	.12	N	15	10	30	GR
R108	N	L	L	N	N	N	300	10	N	10	N	150	.12	N	15	10	45	GR
R109	N	50	N	N	70	N	150	300	N	50	N	50	.12	N	380	15	55	GN
R109	N	15	L	N	30	N	1500	200	N	30	N	150	.16	N	40	15	40	GN
R110	L	1000	N	N	30	N	100	150	N	15	N	150	.08	N	20	5	20	GN
R111	N	50	10	N	30	N	300	150	N	15	N	70	L	N	70	5	65	GN
R112	N	20	N	N	5	N	L	100	N	10	N	50	.02	N	75	60	70	GN
R113	L	70	10	N	30	N	150	100	N	15	N	30	.02	N	L	45	20	GN
R114	N	5	10	N	5	N	200	10	N	10	N	150	.02	N	35	50	15	GN
R115	N	70	20	N	30	N	500	150	N	30	N	100	.04	N	15	400	55	GN
R116	N	30	L	N	50	N	300	150	N	15	N	30	N	N	30	5	L	GR
R117	N	150	N	N	50	N	300	200	N	15	N	50	N	N	20	L	40	GR
R118	N	L	N	N	N	N	N	10	N	L	N	10	.04	N	N	L	5	GN
R119	N	50	N	N	100	N	500	500	N	10	N	10	N	N	95	5	25	GN
R120	N	200	N	N	15	N	N	70	N	N	L	20	.02	N	N	10	65	GN
R121	N	5	10	N	30	N	300	150	N	20	N	70	N	N	85	5	30	GN
R121	N	10	L	N	20	N	200	150	N	30	N	50	N	N	300	5	15	GN
R122	N	300	N	N	30	N	200	150	N	20	N	50	.02	N	25	10	30	GN
R123	N	5	10	N	20	N	500	200	N	30	N	30	.02	N	420	10	15	GN
R124	L	30	L	N	10	N	700	70	N	20	N	100	.02	N	15	10	10	GN
R125	N	300	N	N	30	N	500	150	N	20	N	100	.02	N	10	L	35	GN
R126	N	5	L	N	15	N	L	100	N	15	N	150	.10	N	35	5	40	GN
R127	N	150	N	N	50	N	100	200	N	15	N	20	.04	N	40	L	10	GN
R128	N	N	10	N	20	N	500	150	N	30	N	150	.10	N	15	L	40	GN
R128	N	L	20	N	L	N	700	15	N	L	N	70	.02	N	L	L	25	GN
R129	N	70	10	N	10	N	200	1500	N	30	2000	150	.02	N	55	5	790	GN
R130	N	L	N	N	N	20	100	L	N	N	N	10	N	N	L	L	L	SH
R131	N	L	N	N	N	N	N	L	N	N	N	N	L	N	5	45H	L	GN
R132	N	L	L	N	7	N	700	70	N	20	N	150	.10	N	10	5	40	GN
R133	N	300	N	N	20	N	150	200	N	30	N	50	L	N	15	5	50	GN
R134	N	30	L	N	30	N	1000	150	N	20	N	50	.12	N	L	5	45	GN
R134	N	70	N	N	50	N	150	200	N	70	300	70	.10	N	L	10	70	GN
R135	N	30	N	N	10	N	500	30	N	15	N	70	L	N	5	10	55	GN
R136	N	10	20	N	10	N	700	70	N	20	N	70	L	N	5	220	50	GR
R137	N	7	10	N	15	N	700	70	N	15	N	50	L	N	L	85	35	GR
R138	N	3000	L	N	10	N	N	30	N	N	N	L	.02	N	L	15	30	UM
R139	L	200	15	N	30	N	300	200	N	20	N	70	N	N	80	15	150	SH
R140	L	100	15	N	30	N	500	150	N	15	N	50	.02	N	55	20	60	SH
R141	N	5	10	N	50	15	L	200	N	20	300	30	N	N	35	15	120	SH
R142	N	30	15	N	50	N	150	500	N	N	500	30	N	N	180	15	200	SH
R143	L	5	200	N	15	15	N	20	N	30	N	150	N	N	N	320	20	SH
R144	N	30	10	N	30	N	200	200	N	30	N	50	.04	N	110	5	40	SH
R145	N	150	L	N	50	N	200	300	N	20	L	30	0.02	N	20	10	10	SH
R146	N	150	N	N	70	N	100	300	N	10	N	20	N	N	5	L	L	SH
R147	20	300	N	N	30	N	700	150	N	20	N	150	.14	.10	45	5	30	SH

TABLE 8.—Continued

Sample number	Field number	Values in percent--Continued				Values in parts per million--Continued													
		Fe	Mg	Ca	Ti	Mn	Ag	As	Au	B	Ba	Be	Bi	Cd	Co	Cr	Cu	La	Mo
R147	74AF251B	15.0	7.00	15.00	>1.000	1500	N	N	N	15	150	1.0	N	N	150	500	100	N	N
R148	73BC254A	3.0	5.00	5.00	.700	700	N	N	N	10	200	1.5	N	N	30	700	50	30	N
R149	73BC258A	3.0	3.00	3.00	1.000	700	N	N	N	N	200	1.0	N	N	30	300	5	30	7
R150	73BC336B	3.0	3.00	2.00	.300	700	3.0	N	N	N	N	L	N	N	20	300	15	20	20
R150	73BC336C	.3	.20	7.00	.020	700	N	N	N	L	N	N	N	N	N	10	5	N	50
R151	73DG275A	.3	.50	N	.200	30	.7	N	N	30	5000	1.5	L	N	N	70	5	L	50
R152	74AF233A	3.0	1.50	2.00	.300	500	2.0	N	N	N	700	2.0	N	N	15	100	30	50	N
R153	74DB324C	5.0	1.00	1.50	.300	1000	.5	N	N	10	1500	2.0	N	N	15	70	50	L	30
R154	74CC087G	10.0	2.00	.50	.150	1500	.5	N	N	N	30	N	N	N	15	150	500	N	N
R155	74CC086B	7.0	2.00	2.00	.500	1500	N	N	N	N	300	N	N	N	30	200	100	N	N
R156	74DB322B	10.0	3.00	.10	.150	1000	.5	N	N	N	100	N	N	N	50	20	150	N	100
R157	74DG301B	5.0	2.00	.70	.150	500	N	N	N	L	2000	1.0	N	N	L	L	70	N	N
R157	74DG301D	7.0	2.00	7.00	.200	1500	.5	N	N	L	>5000	N	N	N	10	10	1500	N	10
R158	74CN130B	3.0	.70	.30	.100	150	N	N	N	L	1000	1.0	N	N	5	20	15	N	N
R159	74CN133C	7.0	1.50	3.00	.500	500	N	N	N	N	200	N	N	N	70	1500	100	N	N
R160	74CN082A	15.0	10.00	10.00	1.000	1000	N	N	N	15	150	1.0	N	N	100	700	150	N	N
R161	74AF066A	7.0	2.00	3.00	.500	1000	N	N	N	L	2000	N	N	N	15	30	10	N	N
R162	74AF163A	7.0	3.00	.50	.700	1500	N	N	N	N	2000	L	N	N	30	200	70	70	N
R163	74DB164A	3.0	7.00	>20.00	.050	700	N	N	N	L	L	N	N	N	N	20	N	N	N
R164	74DB162C	10.0	5.00	5.00	1.000	1500	N	N	N	N	L	L	N	N	100	1000	L	N	N
R165	74CN078C	5.0	1.00	1.00	.300	500	N	N	N	L	500	1.0	N	N	7	30	7	20	N
R166	74DG209A	5.0	2.00	2.00	.300	1500	1.5	N	N	L	3000	L	N	N	20	300	70	N	10
R167	74CN070B	1.0	.50	1.00	.050	70	N	N	N	N	>5000	L	N	N	N	N	15	N	N
R168	74CN072A	15.0	7.00	15.00	.300	1000	N	N	N	10	100	N	N	N	100	150	7	N	N
R169	74CN071B	10.0	7.00	7.00	.300	1000	N	N	N	10	700	N	N	N	70	150	70	N	N
R170	73DG260A	2.0	1.50	2.00	.300	700	N	N	N	L	1500	1.0	N	N	15	20	20	L	20
R171	74WV186D	7.0	1.50	7.00	.500	700	N	N	N	15	20	5.0	N	N	20	150	5	50	N
R172	74DG158B	3.0	1.50	3.00	.070	>5000	3.0	N	N	N	1000	L	N	N	15	70	500	N	7
R173	73DG265A	1.0	.50	.70	.200	150	L	200	N	L	3000	L	N	N	N	N	10	100	N
R174	73DG264A	3.0	2.00	.70	.300	500	1.0	N	N	10	3000	2.0	N	N	15	100	150	20	10
R175	74AF209A	2.0	1.00	.30	.300	150	N	N	N	50	2000	1.5	N	N	5	150	30	20	N
R176	74WV181A	1.5	.50	1.00	.100	150	N	N	N	L	700	L	N	N	5	L	10	20	50
R177	74DB194B	5.0	1.50	3.00	.300	1000	N	N	N	N	300	L	N	N	15	30	15	N	N
R178	74AF124A	10.0	2.00	5.00	1.000	2000	N	N	N	L	1500	1.0	N	N	20	200	150	50	7
R179	73HB002A	7.0	5.00	1.50	.500	1000	N	N	N	N	150	N	N	N	100	700	L	30	N
R180	73HB004A	5.0	5.00	2.00	.200	1000	N	N	N	L	200	N	N	N	50	2000	70	N	N
R181	73HB006B	2.0	.50	.50	.020	150	5.0	N	N	L	1000	1.5	10	N	N	N	200	N	N
R182	73HB016C	10.0	2.00	.50	.500	1000	1.5	N	N	N	1500	L	N	N	100	N	500	N	N
R183	73HB018A	10.0	.10	N	.070	10	2.0	N	N	N	700	L	N	N	7	20	20	30	10
R184	74DG241A	7.0	>10.00	1.00	>1.000	2000	.5	N	N	10	>5000	1.5	N	N	50	300	5	70	15

R185	73DB016B	.3	.70	20.00	.020	100	3.0	N	N	N	30	N	N	N	N	15	N	L	5
R186	73DB013B	.7	.30	1.50	.020	1000	N	N	N	10	150	L	N	N	N	10	L	N	N
R187	73DB003A	2.0	.70	.07	.200	10	1.0	N	N	10	2000	1.0	N	N	5	30	7	50	20
R188	73HB027B	.7	.50	15.00	.020	700	1.0	N	N	N	70	N	N	N	5	10	10	N	N
R189	74CN097C	15.0	10.00	7.00	.500	1000	N	N	N	10	500	L	N	N	100	500	10	N	N
R190	74CN098A	10.0	3.00	1.00	.500	700	L	N	N	15	2000	1.0	N	N	15	20	70	30	N
R191	74WV158B	1.5	1.50	20.00	.070	700	N	N	N	N	150	L	N	N	N	30	L	N	N
R192	74DB125D	3.0	5.00	1.50	.500	500	N	N	N	N	50	L	N	N	30	1000	15	20	N
R193	74WV043A	7.0	1.50	5.00	.500	1500	N	N	N	N	3000	1.0	N	N	5	10	L	50	N
R194	74AF177D	3.0	.10	1.00	.100	500	N	N	N	N	200	7.0	N	N	5	20	L	200	N
R195	74WV150A	1.5	1.50	5.00	.100	1000	N	N	N	30	2000	L	N	N	7	20	20	N	10
R196	74DB218B	1.0	.50	.10	.200	150	.5	N	N	10	> 5000	1.0	N	30	7	70	150	N	50
R196	74DB218C	.3	.05	.05	.020	50	N	N	N	N	1500	N	N	N	5	L	15	N	N
R197	74WV055A	2.0	1.00	.10	.150	150	1.5	N	N	15	> 5000	L	N	N	N	70	20	N	L
R198	73DG189A	1.5	1.00	20.00	.150	150	1.0	N	N	20	1500	L	N	N	5	150	5	30	N
R199	73DB165C	1.0	.70	1.00	.150	200	1.5	N	N	L	1000	1.0	N	N	N	20	L	20	20
R200	73DG239A	3.0	1.00	2.00	.300	1000	N	N	N	L	2000	1.5	N	N	7	10	L	20	50
R201	73BL003A	5.0	2.00	.20	.500	700	N	N	N	N	500	1.0	N	N	20	10	L	70	50
R202	73HB034B	3.0	1.50	.30	.200	1500	2.0	N	N	10	300	L	N	N	10	10	10	N	N
R203	73BC331A	3.0	2.00	1.00	.200	1000	L	N	N	15	700	1.5	L	N	20	100	200	50	5
R204	73DG245A	.3	.50	L	.200	700	2.0	N	N	15	2000	1.5	N	N	N	30	L	20	50
R205	73AF107B	7.0	2.00	.50	1.000	150	2.0	N	N	10	1500	2.0	N	N	5	150	20	30	100
R206	73AF106A	3.0	3.00	1.50	.500	500	.7	N	N	10	>5000	5.0	N	N	7	15	5	150	5
R207	74WV050A	7.0	1.50	5.00	.500	1500	N	N	N	L	2000	1.0	N	N	5	N	L	N	100
R208	74WV052A	10.0	2.00	5.00	.700	1500	N	N	N	L	3000	L	N	N	7	L	L	20	100
R209	74DB209B	7.0	2.00	2.00	>1.000	300	1.5	N	N	L	>5000	1.0	N	N	70	70	300	N	N
R210	74DG196A	.7	1.00	3.00	.500	700	2.0	N	N	N	1500	L	N	N	5	10	100	20	5
R211	74DG173A	7.0	1.50	5.00	.700	1500	N	N	N	N	3000	L	N	N	10	10	L	70	15
R212	74AF109C	7.0	5.00	10.00	.700	1500	3.0	N	N	N	700	1.5	N	N	50	2000	100	L	N
R213	74AF108C	15.0	3.00	7.00	1.000	700	N	N	N	20	150	L	N	N	100	15	700	N	N
R214	74AF106B	10.0	5.00	10.00	.500	1000	N	N	N	N	30	N	N	N	100	200	3000	N	N
R214	74AF106G	10.0	3.00	10.00	.700	1000	N	N	N	N	50	N	N	N	150	300	3000	N	N
R215	74CC010A	10.0	3.00	5.00	.300	700	N	N	N	N	30	N	N	N	30	700	100	N	N
R216	73DG288B	2.0	1.00	1.00	.200	700	N	N	N	10	500	1.0	N	N	10	10	20	30	7
R217	73BL006A	2.0	.50	.15	.150	300	N	N	N	L	300	1.0	N	N	10	50	10	20	70
R218	74DB104A	7.0	5.00	5.00	.500	1000	N	N	N	N	300	L	N	N	50	700	50	20	N
R219	73DB149D	.7	.02	.05	.070	70	.5	N	N	L	50	N	N	N	N	N	L	20	N
R220	74DG131A	7.0	1.50	3.00	>1.000	200	50.0	N	N	10	2000	L	N	N	15	50	50	100	N
R221	74CN051A	3.0	1.00	.07	.150	700	N	N	N	L	500	30.0	N	N	10	15	5	150	L
R222	73DB145B	3.0	1.00	.30	.200	700	N	N	N	L	300	L	N	N	5	15	50	20	N
R222	73DB145D	3.0	.02	N	.020	15	2.0	N	N	L	20	N	N	N	N	10	1500	L	N
R223	73DB170B	1.5	.15	L	.100	50	N	N	N	L	150	L	N	N	N	10	5	L	N
R224	73SN010A	5.0	1.00	.20	.300	300	L	N	N	10	200	1.0	N	N	20	70	150	20	N
R225	73AF094B	3.0	1.50	1.50	.500	3000	L	200	N	L	3000	2.0	N	N	15	100	100	50	10
R226	73DG371A	3.0	.10	.50	.070	150	20.0	N	N	L	20	1.0	N	N	N	N	10	50	N
R227	74AF137A	1.0	1.00	20.00	.050	1000	N	N	N	N	L	L	N	N	L	15	L	N	N
R228	74WV121A	2.0	.50	.70	.150	500	N	N	N	N	700	2.0	N	N	5	10	L	70	N
R229	74WV183A	5.0	1.50	1.50	.200	500	N	N	N	L	500	L	N	N	15	L	15	20	N

TABLE 8.—Continued

Sample number	Values in parts per million--Continued																	Bedrock geo-chemical unit
													Instrumental	Atomic absorption				
	Nb	Ni	Pb	Sb	Sc	Sn	Sr	V	W	Y	Zn	Zr	Hg	Au	Cu	Pb	Zn	
R147	20	300	N	N	30	N	700	150	N	30	N	200	.12	.10	50	5	30	SH
R148	20	150	L	N	30	N	2000	200	N	20	N	100	N	N	85	5	20	GR
R149	20	100	L	N	20	N	700	150	N	20	N	150	N	N	10	5	25	GR
R150	N	50	L	N	20	N	100	150	N	15	N	30	.02	N	20	15	50	SH
R150	N	5	L	N	L	N	500	10	N	L	N	10	.02	N	5	20	10	SH
R151	L	5	15	N	15	N	N	2000	N	10	N	100	.14	N	L	15	10	SH
R152	N	50	L	N	15	N	200	100	N	20	N	150	.04	N	40	10	25	SH
R153	N	50	50	N	30	N	100	150	N	30	N	150	.02	.10	40	15	100	SH
R154	N	15	N	N	30	N	N	150	N	15	N	30	.08	N	340	5	15	SH
R155	N	30	L	N	50	N	200	200	N	20	N	70	.12	N	70	L	10	GR
R156	N	30	N	N	50	N	N	150	N	15	300	20	.10	N	140	5	30	SH
R157	N	L	150	N	15	N	100	30	N	20	N	100	L	N	75	60	70	SH
R157	N	5	150	N	30	N	500	300	N	15	500	20	L	N	500	180	400	SH
R158	N	30	N	N	30	N	N	30	N	30	N	100	.06	.40	20	L	80	SH
R159	N	200	N	N	50	N	150	200	N	30	N	50	L	N	120	5	35	SH
R160	N	300	N	N	30	N	500	150	N	30	N	70	N	N	55	L	30	SH
R161	N	5	15	N	30	N	700	150	N	30	N	70	.10	N	10	5	35	GR
R162	L	70	30	N	30	N	200	150	N	30	N	150	N	N	50	5	35	GR
R163	N	L	20	N	L	N	3000	15	N	20	N	30	.08	N	5	50	20	SH
R164	N	300	L	N	50	N	150	150	N	30	N	70	.04	N	L	10	10	SH
R165	N	15	10	N	7	N	L	50	N	L	N	300	.75	N	10	L	25	SH
R166	N	70	30	N	30	N	200	150	N	15	N	70	.02	N	70	15	50	SH
R167	N	N	70	N	N	N	500	20	N	L	N	20	L	N	20	35	10	GR
R168	N	100	L	N	50	N	150	200	N	20	N	50	L	N	5	L	L	GN
R169	N	70	L	N	50	N	200	200	N	15	N	50	.14	N	65	L	5	GN
R170	N	10	15	N	10	N	500	150	N	15	N	100	N	N	10	5	40	GR
R171	N	50	10	N	20	N	700	100	N	50	N	200	.02	N	5	10	15	GN
R172	N	50	N	N	5	N	100	200	N	30	200	50	.06	N	220	5	50	GN
R173	L	L	50	N	5	N	300	20	N	10	N	200	.02	N	L	L	25	GN
R174	20	50	10	N	15	N	150	200	N	10	700	150	.02	N	90	10	350	GN
R175	N	30	10	N	20	N	L	150	N	10	N	150	L	N	10	15	270	GN
R176	N	7	10	N	5	N	300	20	N	L	N	70	.02	N	10	L	30	GN
R177	N	10	10	N	20	N	500	100	N	15	N	150	.12	N	20	5	25	GN
R178	30	70	15	N	50	N	300	100	N	50	N	150	.06	N	85	10	65	GR
R179	20	150	L	N	50	N	300	200	N	20	N	150	.02	N	100	10	70	SH
R180	N	500	N	N	30	N	L	150	N	10	N	30	.02	N	140	10	30	SH
R181	L	L	200	N	N	N	100	10	N	10	2000	70	.90	N	300	350	1100	SH
R182	N	10	L	N	50	N	L	300	N	30	N	100	.02	N	340	10	70	SH
R183	N	150	15	N	5	N	N	50	N	20	N	20	.24	N	30	30	65	SH
R184	30	150	300	N	30	N	200	200	N	30	200	100	.08	N	L	70H	100	SH

R185	N	7	L	N	N	N	500	150	N	10	N	10	N	N	10	40	40	SH
R186	N	10	10	N	L	N	150	30	N	N	N	10	.02	N	15	65	15	SH
R187	N	20	15	N	10	N	N	1000	N	L	N	70	.18	N	15	20	130	SH
R188	N	7	100	N	L	N	500	15	N	N	N	N	N	N	10	90	10	SH
R189	N	150	N	N	50	N	150	100	N	15	N	70	L	N	15	L	15	SH
R190	L	30	20	N	30	N	300	500	N	30	N	150	N	.05	45	5	280	SH
R191	N	5	N	N	N	N	300	50	N	15	N	20	.02	N	5	50H	15	SH
R192	L	500	N	N	15	N	200	70	N	15	N	70	N	N	10	L	10	SH
R193	L	L	15	N	15	N	1000	150	N	30	L	150	L	.05	L	5	95	SH
R194	150	L	10	N	7	N	100	L	N	70	N	>1000	.04	N	L	15	65	SH
R195	N	50	10	N	7	N	300	200	N	15	500	50	.04	N	25	30	320	SH
R196	N	70	L	N	10	N	L	3000	N	30	1000	150	.30	N	240	10	1200	SH
R196	N	15	N	N	N	N	N	150	N	L	300	L	.02	N	40	10	310	SH
R197	N	L	L	N	10	N	N	150	N	L	N	70	.08	N	20	L	L	SH
R198	N	50	L	N	7	N	700	150	N	20	500	70	.40	N	15	10	300	SH
R199	N	5	10	N	7	N	100	200	N	10	N	70	.06	N	10	5	15	SH
R200	L	5	15	N	15	N	700	150	N	20	N	100	N	N	5	5	55	GR
R201	L	5	L	N	20	N	100	150	N	30	N	100	N	N	5	10	85	SH
R202	N	5	100	N	15	N	N	70	N	15	300	50	.02	.10	40	170	400	SH
R203	L	30	70	N	15	10	100	100	N	30	300	150	N	N	110	50	300	SH
R204	N	10	10	N	5	N	N	1000	N	L	N	70	.16	N	L	10	45	SH
R205	30	5	100	N	30	N	100	200	N	10	N	150	N	N	20	75	10	SH
R206	30	15	150	N	7	10	200	30	N	70	N	700	N	N	5	110	90	SH
R207	L	L	15	N	10	N	1000	150	N	20	L	100	N	N	L	L	25	GR
R208	L	L	15	N	15	N	1000	150	N	30	L	150	N	N	L	L	25	GR
R209	L	70	10	N	50	L	300	300	N	30	N	100	.02	N	190	15	50	SH
R210	L	L	15	N	10	N	1000	70	N	30	N	100	.02	N	150	L	130	SH
R211	L	L	20	N	20	N	1500	150	N	50	N	200	.02	N	5	5	55	GR
R212	N	150	10	N	100	N	500	200	N	50	N	100	.02	N	110	L	L	UM
R213	N	10	N	N	>100	N	700	1000	N	20	N	20	.04	N	1000	5	15	UM
R214	N	150	N	N	100	N	100	150	N	L	N	10	.08	N	2200	5	10	UM
R214	N	100	N	N	100	N	100	200	N	L	N	15	.08	N	1900	L	10	UM
R215	N	100	N	N	50	N	500	150	N	20	L	20	.24	N	150	5	60	SH
R216	L	5	30	N	15	20	300	70	N	20	N	100	.02	N	20	5	25	SH
R217	L	20	20	N	10	N	100	50	N	10	N	150	N	N	10	15	35	SH
R218	L	150	L	N	30	N	200	150	N	30	L	70	.22	N	45	10	30	SH
R219	N	5	20	N	N	N	N	15	N	10	N	N	.02	N	5	75	30	SH
R220	50	15	10	N	30	N	300	150	N	50	L	150	N	N	15	5	65	SH
R221	N	70	15	N	7	10	L	70	L	70	L	>1000	.02	N	5	5	95	SH
R222	N	5	10	N	15	N	100	100	N	20	500	100	.06	N	95	5	400	SH
R222	N	5	50	N	L	N	L	10	N	N	N	30	.04	N	1300	110	100	SH
R223	N	5	N	N	L	N	N	20	N	L	N	150	.16	N	10	N	10	SH
R224	L	50	15	N	10	N	100	70	N	10	N	200	N	.20	130	10	40	SH
R225	20	70	15	N	20	N	200	500	N	50	L	150	N	N	110	15	180	SH
R226	N	5	L	N	7	N	L	10	N	50	N	150	N	N	L	N	10	SH
R227	N	L	70	N	L	N	1000	10	N	10	N	20	.02	N	10	75	5	GN
R228	L	5	50	N	5	15	150	30	N	30	N	100	.02	N	L	5	20	SH
R229	N	5	10	N	15	N	300	100	N	15	N	20	.02	N	20	85	40	GR

TABLE 8.—Continued

Sample number	Field number	Values in percent--Continued				Values in parts per million--Continued													
		Fe	Mg	Ca	Ti	Mn	Ag	As	Au	B	Ba	Be	Bi	Cd	Co	Cr	Cu	La	Mo
R229	74WV183B	10.0	2.00	2.00	0.300	700	N	N	N	L	700	N	N	N	50	100	30	N	N
R230	74AF123A	7.0	7.00	7.00	.300	1500	N	N	N	L	200	L	N	N	30	3000	30	N	N
R231	74DB193A	15.0	7.00	.70	.150	1000	N	N	N	N	700	L	N	N	150	>5000	20	N	N
R232	74WV190B	1.0	.50	20.00	.100	150	N	N	N	10	100	L	N	N	5	20	10	N	N
R233	74DB195B	3.0	1.00	2.00	.300	500	.5	N	N	N	1000	1.0	N	N	7	15	70	500	N
R234	74DB205A	7.0	5.00	7.00	.070	1000	N	N	N	N	L	N	N	N	50	1500	L	N	N
R234	74DB205B	20.0	1.50	2.00	.150	700	1.5	N	N	10	L	1.0	N	N	70	70	1000	20	N
R235	74DB206B	10.0	1.50	15.00	.300	3000	N	N	N	N	20	L	N	N	15	200	L	20	N
R236	73DB216D	3.0	2.00	.50	.200	200	.5	N	N	L	500	L	N	N	10	10	700	30	7
R237	73DB212A	2.0	.70	1.50	.200	300	20.0	N	N	L	500	1.0	N	N	5	N	15	30	N
R238	73AF158A	3.0	1.00	1.50	.150	700	N	N	N	L	1000	L	N	N	15	50	500	20	N
R239	73DG316A	1.5	1.00	.50	.150	150	.5	N	N	L	3000	1.0	N	N	7	30	100	20	20
R240	74AF073C	10.0	2.00	2.00	.500	1000	L	N	N	N	300	L	N	N	20	150	50	N	100
R241	74AF074A	15.0	5.00	5.00	.500	1000	N	N	N	N	L	N	N	N	70	2000	70	N	N
R242	74DG136A	7.0	3.00	5.00	.500	1500	.7	N	N	N	L	L	N	N	30	70	700	N	N
R243	73DG182B	2.0	.50	.15	.100	700	N	N	N	L	300	L	10	N	5	N	300	20	N
R244	73DB181B	2.0	.50	1.00	.150	200	N	N	N	L	300	1.0	L	N	5	N	100	20	30
R245	73DB176B	3.0	3.00	5.00	.300	1000	N	N	N	N	50	L	10	N	50	700	200	N	N
R246	73DB179C	2.0	.50	3.00	.100	300	N	N	N	10	500	1.0	N	N	7	15	20	30	N
R247	73DB178A	3.0	2.00	2.00	.500	1000	N	N	N	L	300	1.0	N	N	20	20	15	30	20
R248	73DB173B	5.0	3.00	7.00	.500	1000	N	N	N	N	700	L	N	N	30	300	7	N	50
R248	73DB173E	2.0	.15	.70	.050	300	N	N	N	L	300	1.0	N	N	N	N	5	20	50
R249	73DB172D	.2	.05	.05	.010	20	N	N	N	L	L	L	N	N	N	N	L	20	50
R250	74DG134C	2.0	.50	1.50	.200	300	1.0	N	N	N	>5000	1.5	N	50	7	100	150	N	30
R251	74DG133B	3.0	1.50	2.00	.300	500	.7	N	N	N	5000	1.0	N	N	15	70	70	N	N
R252	73BC360A	3.0	2.00	2.00	.300	700	N	N	N	L	700	1.0	10	N	N	15	50	N	N
R253	73SN014B	3.0	1.50	1.50	.200	500	.5	N	N	L	1500	1.0	N	N	20	10	500	50	7
R254	73BL023A	1.0	.70	1.50	.150	200	.5	N	N	10	5000	1.5	L	N	7	100	100	20	30
R255	74DB184E	5.0	5.00	7.00	.300	1500	N	N	N	N	200	L	N	N	30	2000	15	N	N
R256	73DG335B	3.0	3.00	1.50	.700	2000	N	N	N	L	500	1.5	N	N	50	20	30	50	5
R257	73DG340A	3.0	10.00	.50	.030	700	N	N	N	10	50	N	N	N	70	5000	10	N	10
R258	73SN019A	2.0	1.00	.70	.150	500	N	N	N	L	300	1.0	N	N	7	10	10	30	50
R259	73BL016A	2.0	1.00	1.50	.200	500	N	N	N	L	2000	1.0	10	N	7	N	20	20	5
R260	73BL012A	2.0	1.00	1.50	.150	500	N	N	N	L	1000	1.0	10	N	5	N	30	30	7
R261	73DB197A	2.0	.70	1.00	.150	500	N	N	N	L	700	1.0	10	N	5	N	100	20	N
R262	73BL014A	3.0	1.00	1.50	.200	500	N	N	N	L	1500	1.0	10	N	7	N	30	30	5

Map number	Values in parts per million--Continued																Bedrock geochemical unit
												Instrumental	Atomic absorption				
	Nb	Ni	Pb	Sb	Sc	Sn	Sr	V	W	Y	Zn	Zr	Hg	Au	Cu	Pb	Zn	
R229	N	30	15	N	30	N	500	150	N	15	N	30	0.02	N	25	30	30	GR
R230	N	1000	L	N	20	N	200	100	N	10	N	70	L	N	25	5	15	GN
R231	N	1500	L	N	10	N	L	70	N	N	200	10	L	N	15	20	75	UM
R232	N	L	N	N	5	N	1000	15	N	10	N	100	L	N	5	35H	10	GN
R233	L	L	30	N	15	20	500	20	N	30	N	150	.02	N	30	5	25	SH
R234	N	100	L	N	50	L	200	150	N	L	N	10	.04	N	N	15	L	GN
R234	N	70	L	N	15	L	100	70	70	15	N	50	.02	N	750	15	15	GN
R235	N	70	70	N	30	L	100	100	N	50	L	100	.02	N	N	35	10	GN
R236	L	7	10	N	15	N	100	100	N	10	N	70	.02	N	620	L	55	GN
R237	N	5	10	N	5	N	500	50	N	L	N	150	N	N	L	L	30	GN
R238	N	30	L	N	15	N	150	100	N	20	N	50	N	N	330	L	40	SH
R239	N	30	15	N	10	N	100	500	N	10	500	50	.04	N	55	20	650	SH
R240	N	70	L	N	50	N	200	200	N	50	L	70	N	.10	25	5	20	SH
R241	N	500	10	N	70	N	150	200	N	20	L	50	N	N	60	L	10	SH
R242	N	50	L	N	50	N	100	200	N	30	N	50	.02	N	880	L	10	SH
R243	N	5	20	N	7	L	N	10	N	15	500	70	.02	N	160	L	150	GN
R244	N	L	10	N	10	N	150	30	N	20	N	100	N	N	35	L	25	GN
R245	N	100	10	N	30	N	150	200	N	15	N	30	.02	N	15	N	5	GN
R246	L	10	10	N	7	N	500	30	N	20	N	50	.02	.05	45	15	15	GN
R247	N	15	10	N	20	N	700	150	N	15	N	50	N	N	15	5	45	GR
R248	N	30	10	N	50	N	500	300	N	20	N	30	N	N	15	15	10	SH
R248	L	5	10	N	7	L	150	10	N	30	N	100	.02	N	15	L	40	SH
R249	N	5	N	N	N	N	N	15	N	N	N	10	N	N	L	N	L	SH
R250	N	70	10	N	15	N	100	1000	N	50	2000	70	.02	N	120	5	1400	SH
R251	N	70	15	N	20	N	200	500	N	20	1000	70	.02	N	85	5	590	SH
R252	L	7	20	N	15	N	700	150	N	15	N	20	N	N	15	5	45	GR
R253	N	5	20	N	7	N	500	150	N	10	N	150	N	N	470	10	65	GN
R254	N	100	20	N	7	N	300	1000	N	30	500	70	N	N	50	5	550	GN
R255	N	150	L	N	70	N	200	150	N	20	N	30	.02	N	5	15	40	GN
R256	30	20	20	N	30	15	300	200	N	50	300	100	.02	N	25	10	180	GR
R257	N	2000	10	N	10	N	N	70	N	N	N	N	N	N	5	20	55	UM
R258	L	10	20	N	5	N	500	50	N	10	N	200	N	N	L	5	55	GN
R259	L	L	50	N	10	N	500	70	N	15	N	70	N	N	L	L	35	GR
R260	L	5	50	N	5	N	500	30	N	10	N	30	N	N	L	5	40	GR
R261	N	5	30	N	7	N	500	50	N	10	N	100	.02	N	L	L	40	GR
R262	L	5	30	N	10	N	500	70	N	10	N	70	.02	N	L	10	35	GR

TABLES 1-37

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 for rock types are as follows: AK, alaskite, AM, amphibolite, AN, andesite, AP, 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, periodotite, 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.]

Sample number	Field number	Description				
			Mineralization			
		Rock type	Background, no visible sulfides	Fe stain	Visible sulfides	Remarks
R001	75AF095A	AM	X	-----	--------	------------------
R001	75AF095B	AM	X	-----	--------	------------------
R002	75DB074A	GN	X	-----	--------	------------------
R002	75DB074B	GN	----------	X	--------	------------------
R002	75DB074C	GN	----------	X	--------	Zone 1 X 5 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	-----	--------	------------------
R012	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	--------	Zone 1 X 5 m.
R023	74DB086B	AP	X	-----	--------	------------------
R024	74DB084A	GD	X	-----	--------	------------------
R025	75BJ044A	GR	X	-----	--------	------------------
R026	75CN060A	PR	X	-----	--------	------------------
R027	75DG004A	SC	X	-----	--------	------------------
R027	75DG004B	QM	X	-----	--------	------------------
R027	75DG004D	SC	----------	X	--------	Zone 1 X 5 m.
R028	75DB127A	GN	X	-----	--------	------------------
R028	75DB127B	GN	X	-----	--------	------------------
R028	75DB127D	MB	----------	X	--------	------------------
R029	75DG002A	QO	X	-----	--------	------------------
R029	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	-----	--------	------------------
R036	74CN220B	GN	X	-----	--------	------------------
R037	74CC149A	DI	X	-----	--------	------------------
R038	74CC146B	GB	X	-----	--------	------------------

TABLE 9.—Continued

Sample number	Field number	Description				
			Mineralization			
		Rock type	Background, no visible sulfides	Fe stain	Visible sulfides	Remarks
R039	74CN182A	DI	X	-----	--------	------------------
R040	74CN183E	GD	----------	X	--------	------------------
R040	74CN183F	GD	----------	X	--------	------------------
R041	74CC151C	MB	X	-----	--------	------------------
R042	74CN248A	GR	X	-----	--------	------------------
R043	74CN249B	DI	X	-----	--------	------------------
R043	74CN249C	GN	----------	X	--------	------------------
R044	74CN251A	GN	----------	X	--------	------------------
R045	74DB390B	GN	----------	X	--------	Zone 1 m thick.
R046	74DB437A	MB	X	-----	--------	------------------
R047	74DB396B	SK	----------	X	--------	1 X 5 m gossan.
R048	74DB397A	MB	X	-----	--------	------------------
R049	74WV344B	GN	X	-----	--------	------------------
R050	74WV019B	AN	X	-----	--------	------------------
R050	74WV019C	AP	----------	X	--------	------------------
R051	74CC220A	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 zone.
R062	74DB347D	GN	X	-----	--------	------------------
R063	74WV248A	GN	----------	X	X	------------------
R064	74DB369D	SK	----------	X	--------	------------------
R065	74DB370A	GN	X	-----	--------	------------------
R065	74DB370D	HB	X	-----	--------	------------------
R066	74DB373F	SE	X	-----	--------	------------------
R067	74DB308B	GN	----------	X	--------	Zone 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	-----	--------	------------------
R073	74CN201B	GN	----------	X	--------	------------------
R074	74CC161B	GN	X	-----	--------	------------------
R074	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 zone.
R081	73AF285B	SC	----------	X	--------	3 X 50 m bleached zone.
R082	73DG378B	PH	----------	X	X	------------------
R083	73BC400A	GN	X	-----	--------	------------------
R084	73BC398A	GN	X	-----	--------	------------------

TABLE 9.—Continued

Sample number	Field number	Description				
			Mineralization			
		Rock type	Background, no visible sulfides	Fe stain	Visible sulfides	Remarks
R085	73DG397A	QD	X	-----	--------	------------------
R086	73DG394A	QD	X	-----	--------	------------------
R087	73BC404A	QD	X	-----	--------	------------------
R088	74CC139G	CS	X	-----	--------	------------------
R089	74CC138A	QD	X	-----	--------	------------------
R090	73AF271A	PD	X	-----	--------	------------------
R090	73AF271B	PD	X	-----	--------	Altered.
R091	73DB239A	PD	X	-----	--------	------------------
R091	73DB239B	PD	X	-----	--------	------------------
R091	73DB239C	SE	X	-----	--------	------------------
R091	73DB239D	PD	X	-----	--------	------------------
R091	73DB239E	PD	X	-----	--------	------------------
R092	74DB447C	PX	X	-----	--------	------------------
R093	74DB446B	PX	X	-----	--------	------------------
R093	74DB446C	GN	X	-----	--------	------------------
R093	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	-----	--------	------------------
R100	73DB242C	SE	X	-----	--------	------------------
R100	73DB242E	PD	X	-----	--------	------------------
R101	73DG406A	GN	X	-----	--------	------------------
R101	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	------------------
R109	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	--------	Zone 10 X 400 m.
R121	74DB406C	GN	----------	-----	X	Pod 5 X 50 cm.
R122	74WV251C	HB	X	-----	--------	------------------
R123	74DB222C	GN	----------	X	--------	------------------
R124	74CN151D	CS	X	-----	--------	------------------
R125	74CN152B	UP	X	-----	--------	------------------

TABLE 9.—Continued

Sample number	Field number	Description				
			Mineralization			
		Rock type	Background, no visible sulfides	Fe stain	Visible sulfides	Remarks
R126	74CN153C	GN	----------	X	--------	------------------
R127	74CN093A	HB	X	-----	--------	------------------
R128	74CN088A	SW	----------	X	--------	------------------
R128	74CN088C	SW	X	-----	--------	------------------
R129	74DG232A	GN	----------	X	--------	------------------
R130	74CC062C	QZ	X	-----	--------	------------------
R131	74WV165A	MB	X	-----	--------	------------------
R132	74CC093C	GN	X	-----	--------	------------------
R133	74CN138E	IG	X	-----	--------	------------------
R133	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	--------	Zone 30 X 50 m.
R145	74DB296C	GN	X	-----	--------	------------------
R146	74DB297E	SC	X	-----	--------	------------------
R147	74AF251A	GS	X	-----	--------	------------------
R147	74AF251B	GS	----------	-----	X	------------------
R148	73BC254A	PH	X	-----	--------	------------------
R149	73BC258A	PH	X	-----	--------	------------------
R150	73BC336B	PH	X	-----	--------	------------------
R150	73BC336C	QZ	X	-----	--------	------------------
R151	73DG272A	PH	X	-----	--------	------------------
R152	74AF233A	PH	X	-----	--------	------------------
R153	74DB324C	GN	----------	X	--------	Zone 2 m wide.
R154	74CC087G	QZ	X	-----	--------	------------------
R155	74CC086B	GN	X	-----	--------	------------------
R156	74DB322B	GN	----------	X	X	------------------
R157	74DG301B	SC	----------	-----	X	Oxidized zone. 0.3 m wide.
R157	74DG301D	GN	----------	X	--------	Zone 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	--------	------------------

TABLE 9.—Continued

Sample number	Field number	Description				
		Rock type	Mineralization			Remarks
			Background, no visible sulfides	Fe stain	Visible sulfides	
R172	74DG158B	GN	----------	X	--------	Zone 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	-------------------
R182	73HB016C	SC	----------	X	X	Zone 2 m wide.
R183	73HB018A	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	-------------------
R196	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	--------	-------------------
R106	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	-------------------
R214	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	-----	--------	-------------------

TABLE 9.—Continued

Sample number	Field number	Description				
		Rock type	Mineralization			Remarks
			Background, no visible sulfides	Fe stain	Visible sulfides	
R222	73DB145B	GS	----------	-----	X	------------------
R222	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	-----	--------	------------------
R229	74WV183B	GB	X	-----	--------	------------------
R230	74AF123A	HB	X	-----	--------	------------------
R231	74DB193A	UM	X	-----	--------	------------------
R232	74WV190B	MB	X	-----	--------	------------------
R233	74DB195B	GN	----------	X	--------	------------------
R234	74DB205A	GN	X	-----	--------	------------------
R234	74DB205B	GN	----------	X	--------	Zone 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	--------	Zone 10-15 m thick.
R241	74AF074A	SC	X	-----	--------	------------------
R242	74DG136A	AM	X	-----	--------	------------------
R243	73DB182B	GN	----------	X	--------	------------------
R244	73DB181B	GN	----------	X	--------	------------------
R245	73DB176B	SC	----------	X	--------	Zone 1 m thick.
R246	73DB179C	CS	X	-----	--------	------------------
R247	73DB178A	QD	X	-----	--------	------------------
R248	73DB173B	SC	X	-----	--------	------------------
R248	73DB173E	SC	----------	X	--------	------------------
R249	73DB172D	QZ	X	-----	--------	------------------
R250	74DG134C	GN	----------	X	X	------------------
R251	74DG133B	GN	----------	X	--------	Zone 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	-----	--------	------------------

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*

[B in analytical data indicates no value reported.]

Map number	Field number	UTM		PPM	
		X-coordinate	Y-coordinate	U	Th
	73DB140A	588575	6390850	0.359	B
	73DB149A	603600	6383200	2.262	10.763
	73DB152E	581075	6406075	.429	B
	73DB156B	625675	6374375	4.644	11.666
	73DB161A	581200	6408750	.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	.512	B
	73DB178A	618925	6373300	.620	B
	73DB180B	618200	6373650	1.268	B
37	73DB184B	632700	6371750	2.630	17.056
	73DB188A	633150	6373500	.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	.138	1.730
12	73DB241C	597025	6419150	5.934	11.939
	73DB246A	600075	6418150	2.855	3.340
	74DB019B	577250	6429830	.916	3.179
	74DB087A	584350	6447150	1.876	6.158
	74DB105A	602150	6383010	.608	B
	74DB126A	580870	6386940	.689	B
	74DB132A	594850	6386650	2.687	6.409
	74DB134A	607350	6377990	1.460	5.133
	74DB139A	606100	6377250	.499	B
	74DB141A	611420	6372010	.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
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	.467	27.049
	74DB294C	588060	6412800	.271	B
	74DB297A	587000	6412270	.347	B
14	74DB302B	609230	6418450	3.900	20.935
	74DB306A	614040	6426640	1.410	3.152
	74DB312C	592880	6417910	.682	3.124
	74DB317A	593790	6403690	2.290	7.487
	74DB324A	589680	6408540	.791	B
	74DB331A	581910	6421640	.528	B
	74DB334A	583190	6423000	1.603	12.368
	74DB340C	611080	6422040	4.090	11.654
	74DB357B	599540	6429550	.516	B
	74DB359C	603450	6428680	1.720	6.709
	74DB363D	602480	6422200	1.483	6.381
	74DB368C	598200	6427760	.642	B
	74DB371A	611540	6429980	.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	6415880	.529	B
	74DB419B	573410	6433610	.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	.839	B
	73BC319A	601525	6386400	2.128	8.380
	73BC325A	610375	6392725	2.834	B

TABLE 10.—Continued.

Map number	Field number	UTM		PPM	
		X-coordinate	Y-coordinate	U	Th
27	73BC331A	600675	6392400	5.003	15.034
	73BC352B	619325	6372750	.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	.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	.252	5.590
29	74CC035A	610800	6388550	1.032	26.657
	74CC044B	641180	6370010	1.095	B
	74CC049A	599300	6401940	2.178	13.633
22	74CC053C	599750	6304000	7.177	42.488
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	.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	.854	4.855
	74CC109A	587820	6410360	.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	48.486
	74CC196D	599350	6444250	1.331	4.549
2	74CC199A	595270	6439950	5.588	13.219
	74CC218A	577550	6414475	.364	B
	73AF099A	611875	6379375	.445	B
	73AF157A	614600	6376500	.330	B
	73AF166B	613300	6396900	.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	.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	.904	4.445
	73AF234A	621500	6380650	1.977	10.630
	73AF259A	585150	6421350	1.269	3.217
	73AF266B	591700	6420775	2.970	11.596
33	74AF076A	608550	6373100	3.988	15.246
	74AF109B	597140	6383500	1.765	6.469
	74AF258G	570300	6411450	.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	2.838	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	.691	B
	73DG315A	611800	6375150	1.800	7.013
	73DG323B	613100	6372375	B	2.030
38	73DG329B	634250	6368725	2.874	20.007
	73DG335A	629350	6371800	1.656	B
	73DG340A	628650	6370275	.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
	73DG389B	582700	6413700	1.853	5.981

TABLE 10.—Continued

Map number	Field number	UTM X-coordinate	UTM Y-coordinate	PPM U	PPM Th
	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	.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	.776	B
	74CN047A	598600	6386670	1.529	4.888
32	74CN051A	607360	6378210	8.273	33.357
	74CN056A	593450	6381310	3.679	8.665
	74CN071B	602210	6394420	.750	2.141
	74CN076B	627600	6380800	.517	4.697
	74CN084A	637720	6387710	3.309	10.298
	74CN089B	606970	6407670	1.243	13.226
18	74CN093D	612550	6410870	1.635	20.783
25	74CN097A	582000	6389010	3.044	15.052
23	74CN100D	607170	6302300	3.614	22.043
	74CN104B	603250	6413250	1.365	6.086
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	.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	.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	.770	B
	74WV066A	595400	6379180	3.492	11.274
	74WV153B	581190	6389190	1.010	2.351
	74WV158B	579210	6388295	2.327	B
	74WB162B	612900	6405380	4.644	6.292
	74WV168A	588850	6370750	.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	.542	B
	74WV200C	621010	6406300	1.524	9.247
	74WV252B	607020	6414800	.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	.224	B
	74WV277A	588160	6422690	1.895	B
	74WV287A	592800	6432945	.531	B
5	74WV289D	593855	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	6.090
	74WV336A	571860	6437340	.428	B
	74WV341A	606045	6445225	2.545	11.713
	74WV347A	587795	6431595	.902	6.467

TABLE 11.—*Descriptions of selected bedrock geochemical samples listed in table 10*

[Abbreviations for rock type area: AK, alaskite, AM, amphibolite, AN, andesite, AO, aplite, GD, granodiorite, GN, gneiss, GR, granite, QD, quartz diorite, QM, quartz monzonite, QZ, quartzite, SC, schist.]

Map number	Field number	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	74DB241C	AP	X	-------	--------	--------------
13	74DB401A	GR	X	-------	--------	--------------
14	74DB302B	GN	----------	X	--------	Zone 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	--------	Zone 2 m thick.
25	74CN097A	PH	X	-------	--------	--------------
26	73DG243A	AM	X	-------	--------	--------------
27	73BC331A	SC	X	-------	--------	--------------
28	73DG290A	GD	X	-------	--------	--------------
29	73CC035A	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	--------	--------------

TABLE 12.—*Limit of quantitative determination for elements listed in tables 13 through 37*

[In tables 13–37, L indicates element detected but below level of quantitative determination, N indicates element looked for but not detected.]

Semiquantitative spectrographic analysis (ppm)		Atomic absorption analysis (ppm)		Fire assay (ppm)	
Silver	0.5	Copper	5	Gold	0.15
Cadmium	20	Lead	5	Silver[1]	>.15
Arsenic	200	Zinc	5		
Molybdenum	5	Gold	.5		
Nickel	5				

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

TABLE 13.—*Assay data, Point Astley prospect*

Sample number	Sample type	Length		Semiquantitative spectrographic analysis (ppm)		Atomic absorption[1] (ppm)			Fire assay (ppm)		Description
		Ft	(cm)	Ag	Mo	Cu	Pb	Zn	Au	Ag	
						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 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; sphalerite-rich bands parallel 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; some mineralization 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	--	--	Do.
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.

				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	--	--	Do.
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	--	--	Do.
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, some quartz and sulfides.

[1]Atomic absorption gold below 0.05 ppm for all samples.

TABLE 14.—*Assay data,*

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.	--do.	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-ft.	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.	--do.	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 of N18W@65SW. Stringer zones follow foliation.
Marty workings.	31, 36		South side Spruce Creek, 900-ft elevation.	--do.	--do.	Quartz veins at N45-50W@50NE.
Unnamed adit near Marty.	31, 37		South side Spruce Creek, 1180-ft elevation.	Quartz stringer zone.	--do.	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.	--do.	--do.	Stringer zone that follows foliation of N15W@83SW.
Yates adit.	31, 38		South side Spruce Creek, 1450-ft elevation.	Quartz veins.	Brown schist.	Quartz veins at N45W@75NE and N25W@72SW; foliation N25W@72SW.

Spruce Creek prospects

Workings sampled during study	Assay values of best measured samples	Year activity commenced (approx.)	Last reported activity (approx.)	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, p. 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 Report of the Territorial 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, p. 40-41	The main workings, 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, 1937.	--

TABLE 14.—

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@E65-75E.
Keith adit (View Fair claim).	31, 40	----------------	do.------------	Quartz veins, quartz stringer zone.	--do.-------	Quartz veins, N30W@80NE; foliation N20W@70SW.
Yellow Jacket workings.	31, 41	--------------	South side Spruce Creek, 2135-ft elevation.	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.	--do.------------	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-------------------------	

Continued

Workings sampled during study	Assay values of best measured samples	Year activity commenced (approx.)	Last reported activity (approx.)	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, 1915, p. 3	
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, p. 41	
50-ft crosscut and 275-ft drift, plus stope.	0.65-ft channel with 17.08 oz gold/ton.	1927	1927	Buddington, 1923 p. 126; Willis, 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 (5K046).	--	--		
60- and 80-ft-long and 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.	

TABLE 15.—*Assay data, mineralized area near the head of Windham Bay*

Sample number[1]	Sample type	Length		Semiquantitative spectrographic analysis (ppm)		Atomic absorption (ppm)			Description
		Ft	(m)	Ag	Au	Cu	Pb	Zn	
				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.
[2]4S088	Chip------------	5.0	(1.5)	N	.1	10	20	65	Do.
[3]4K091	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.
[4]4K076	--do.-----------	6.0	(1.8)	3	.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---------	.5	(.2)	N	N	5	10	20	Iron-stained quartz vein.
4K081	Random chip-----	--	--	.5	.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)	.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]Samples 4K084-090 were 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 G1000 As.
[4]Fire assay analysis gave 1.4 ppm and 6.5 ppm, respectively, Au and Ag.

TABLE 16.—*Assay data, Spencer's first zone of mineralization*

Sample number	Sample type	Length		Semiquantitative spectrographic analysis (ppm)	Atomic absorption (ppm)			Fire assay (ppm)		Description
		Ft	(cm)	Ag	Au	Pb	Zn	Au	Ag	
					Red Wing 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 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)	.7	L	30	650	--	--	Do.
4S112	Channel--	3.9	(119)	N	.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.
[1]4S114	Chip-----	7.4	(226)	.7	L	65	2400	--	--	Quartz stringer zone in muscovite schist.
					Jenny Reed adit #2					
4S129	Chip-----	10.0	(305)	.5	N	15	490	--	--	Muscovite schist with finely disseminated sulfides.
4S130	--do.----	11.6	(354)	1	L	10	1900	--	--	Do.
					Other samples					
4S056	Channel--	.2	(6)	N	N	70	90	--	--	Quartz vein.
4S057	--do.----	5.7	(174)	.7	N	15	70	--	--	Quartz stringer zone in schist.
4S058	--do.----	.3	(9)	N	.05	10	40	--	--	Quartz vein containing sulfides.
4S059	Composite	5	(152)	.5	.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.

TABLE 17.—*Assay data, Spencer's second zone of mineralization*

	Sample number[1]	Sample type	Length		Semiquantitative spectrographic analysis (ppm)	Atomic absorption (ppm)				Fire assay (ppm)		Description
			Ft	(m)	Ag	Au	Cu	Pb	Zn	Au	Ag	
					Fries workings							
[2]1	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	65	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)	.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	5	--	--	Quartz vein.
20	4K038	Selected grab.	--	--	.7	N	130	30	260	--	--	Selection of high-grade rock from 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.

22	4K025	--do.--	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	.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	.10	35	15	55	--	--	Quartz stringer zone in schist.
	4S099	--do.--	.1	(.03)	N	N	15	25	190	--	--	Quartz vein.
	4S101	--do.--	.6	(.2)	.5	N	L	5	40	--	--	Do.
						Marty mine						
[3]1	4K071	Chip---	.5	(.2)	N	N	L	10	10	--	--	Quartz vein.
2	4K070	--do.--	.4	(.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 same quartz stringers.
4	40-P66	--do.--	73	(22.3)	--	--	--	--	--	N	N	Massive gray schist with few quartz stringers.

[1]Samples 4K144, 4K319-320 were taken in the area and did not contain any significant metal values.
[2]Refer to figure 34.
[3]Refer to figure 36.

TABLE 17.—Continued

	Sample number[1]	Sample type	Length		Semiquantitative spectrographic analysis (ppm)		Atomic absorption (ppm)			Fire assay (ppm)		Description
			Ft	(m)	Ag	Au	Cu	Pb	Zn	Au	Ag	
					Marty mine--Continued							
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.
7	4S120	--do.--	10.0	(3.0)	N	N	10	15	55	N	5.1	Do.
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)	--	--	--	--	--	.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	Do.
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.
34	4S126	--do.--	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	55	--	--	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 quartzose, 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	4K044	--do.--	10.0	(3.0)	L	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	.05	30	10	75	--	--	Quartz stringers in schist.
	4S144	--do.--	.7	(.2)	.5	N	45	10	30	--	--	Schist with quartz stringers.
	4S145	--do.--	.7	(.2)	N	N	N	N	N	--	--	Quartz vein.
	4S147	--do.--	3.5	(1.1)	N	N	L	10	25	--	--	Do.

TABLE 17.—Continued

Sample number[1]	Sample type	Length		Semiquantitative spectrographic analysis (ppm)		Atomic absorption (ppm)			Fire assay (ppm)		Description
		Ft	(m)	Ag	Au	Cu	Pb	Zn	Au	Ag	
Yates adit											
4K108	Channel	9.0	(2.7)	0.5	0.05	25	40	75	N	4.5	Brown schist with irregular quartz pods and stringers.
4K109	--do.--	8.0	(2.4)	N	N	20	5	30	--	--	Light brown schist with thin quartz stringers parallel to foliation.
4K110	--do.--	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)	.5	.25	20	10	80	N	6.2	Muscovite schist with minor stringers parallel to foliation, sampled across face of adit.

					Keith adit							
	4K146	Channel	10.0	(3.0)	.5	.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	10	15	20	5.8	.3	Do.
					Yellow Jacket workings, adit #1							
	4K056	Channel	11.0	(3.4)	.7	.05	55	15	220	.3	L	Iron-stained schist with quartz seams parallel to foliation.
					Yellow Jacket workings, open cut							
	4K057	Channel	8.0	(2.4)	L	.10	40	15	60	1	L	Irregularly foliated schist with quartz veins.
					Yellow Jacket workings, adit #2							
	4K058	Chip---	12.0	(3.7)	.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							
[4]1	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.

[4]Refer to figure 42.

TABLE 17.—Continued

	Sample number[1]	Sample type	Length		Semiquantitative spectrographic analysis (ppm)	Atomic absorption (ppm)				Fire assay (ppm)		Description
			Ft	(m)	Ag	Au	Cu	Pb	Zn	Au	Ag	
					Jensen mine--Continued							
3	4K182	Channel	0.7	(0.2)	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	--do.--	.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	(.4)	N	N	5	L	20	N	N	Iron-stained quartz vein with small galena pods and free gold.
15	4K158	--do.--	.6	(.2)	.5	.50	20	130	110	11.7	5.5	Galena knot noted.
16	4K157	--do.--	.5	(.2)	N	N	5	5	5	2.4	.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.

TABLE 18.—*Assay data, Spencer's third zone of mineralization*

Sample number	Sample type	Length		Semiquantitative spectrographic analysis (ppm)		Atomic absorption (ppm)				Fire assay (ppm)		Description
		Ft	(m)	Ag	As	Au	Cu	Pb	Zn	Au	Ag	
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	Channel--------	4.8	(1.5)	.5	500	L	65	15	85	--	--	Schist with quartz with minor pyrite.
Apache-Navajo prospect--north adit												
3P126	Channel--------	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)	.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.	.1-.8	(.03-.2)	.5	N	N	L	5	20	--	--	Quartz veins.
3P105	--do.----------	.1-3.3	(.03-1.0)	L	200	N	5	L	10	--	--	Do.
3P106	--do.----------	.1-1.0	(.03-.4)	L	N	N	40	5	30	--	--	Do.
3P107	Spaced chip, 1-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-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-ft interval.	18	(5.5)	.5	N	L	90	10	130	--	--	Do.
3P120	Spaced chip, 2-ft interval.	94	(28.7)	.7	N	.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.
3P122	Spaced chip, 2.0-ft interval.	69	(21.0)	1.5	N	L	85	65	440	--	--	Iron-stained schist with stringers.
3P123	Spaced chip, 1.0-ft interval.	17	(5.2)	3	N	.05	230	250	1900	--	--	Do.
3P124	Spaced chip, 2.0 ft interval.	100	(30.5)	1.5	N	N	65	65	240	--	--	Iron-stained schist.
3P125	--do.----------	105	(32.0)	3	N	.05	390	60	2100	--	--	Do.

TABLE 18.—Continued

Sample number	Sample type	Length		Semiquantitative spectrographic analysis (ppm)		Atomic absorption (ppm)				Fire assay (ppm)		Description
		Ft	(m)	Ag	As	Au	Cu	Pb	Zn	Au	Ag	
				Gold shaft prospect								
3P108	Channel--------	1.5	(.5)	2	10000	.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	--	--	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	--	--	Wallrock of 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.
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	.10	60	20	95	--	--	High-grade selection from above section.
4S152	Channel--------	3	(.09)	N	N	N	20	5	60	--	--	Quartz vein.
4S153	Selected grab.	--	--	N	N	N	45	10	100	--	--	High-grade selection of pyrite from above vein.
				Other								
4S157	Selected grab.	--	--	N	N	N	25	10	10	--	--	Iron-stained schist with sulfides.

TABLE 19.—*Assay data, Chuck River lodes and north shore of Windham Bay*

Sample number	Sample type	Length		Semiquantitative spectrographic analysis (ppm)	Atomic absorption (ppm)			Description
		Ft	(m)	Ag	Au	Cu	Pb	
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.
[1]4S155	Spaced chip, 0.5-ft interval.	28	(8.5)	.7	N	25	5	Iron-stained diorite.
Chuck River lodes								
4K117	Spaced chip, 0.5-ft interval.	23	(7.0)	.5	N	45	70	Green-brown phyllite with quartz parallel to foliation.
4K118	Channel----	.3	(.1)	L	15	15	45	Iron-stained quartz vein knots of pyrite.
4K119	--do.------	.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	.05	10	10	Iron-stained chlorite-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.

TABLE 20.—*Assay data,*

Sample	Sample type	Length		Chemical analysis percent				
		Ft	(m)	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	.002	.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 and 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	.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	.001	.040
4S269 - tails.	--do.---------------	--	--	10.1	6.3	--	--	--
4S272	Spaced chip, 0.5-ft interval.	12	(3.7)	--	--	--	--	--

Windham Bay ultramafic area

X-ray fluorescence percent		Activation analysis percent	Davis tube separation percent	Atomic absorption (ppm)	Semiquantitative spectrographic analysis (ppm) percent			Description
Fe	Ti	SiO_2	-100 mesh	Cu	Ni	Cr	Fe	
			North shore of Windham Bay--Continued					
16.8	1.23	42.7	--	220	50	100	15	
2.0	.38	1.9	9.4	--	--	--	--	
11.2	1.33	45.3	--	--	--	--	--	
17.8	1.37	41.3	--	300	50	100	15	
72.4	.46	2.0	8.2	--	--	--	--	
12.3	1.25	43.7	--	--	--	--	--	
--	--	--	--	160	70	300	15	Pyroxenite containing magnetite altered to amphibolite in places with occasional pods pegmatitic biotite amphibolite.
--	--	--	7.9	300	50	150	15	
--	--	--	8.2	200	70	100	15	
--	--	--	--	85	50	100	15	
--	--	--	--	60	20	50	15	
--	--	--	--	7	20	50	15	
--	--	--	11.3	320	70	150	20	
--	--	--	7.4	190	70	150	15	
--	--	--	--	80	50	100	15	
--	--	--	--	80	30	100	10	
--	--	--	--	150	70	150	15	
--	--	--	--	85	50	100	15	
--	2.0	--	--	--	--	--	--	
--	3.3	--	5.9	--	--	--	--	
--	1.9	--	--	--	--	--	--	
--	--	--	--	80	50	300	7	Boulder fan of dark coarse-grained horn-blendite.
--	--	--	--	65	70	200	7	Do.
--	--	--	--	45	30	500	7	Very coarse-grained hornblende with biotite crystals.
--	--	--	--	680	100	150	15	Pyritic portions of hornblende-biotite rocks.
--	--	--	--	250	70	300	7	Hornblende-biotite rocks.
--	--	--	--	15	20	300	7	Fine-grained micaceous and highly-silicified phase of biotite rocks.
--	--	--	--	270	50	150	15	High-grade selection of sulfides in hornblende-biotite rocks.
--	--	--	--	170	30	70	20	Random rubble selection along 100 ft of beach.
			South shore of Windham Bay--Continued					
7.52	.34	48.3	--	L	70	1500	7	Pyroxenite containing magnetite altered to amphibolite in places with occasional pods of pegmatitic biotite amphibolite.
45.5	.16	21.6	9.4	--	--	--	--	
3.71	.38	50.9	--	--	--	--	--	
--	--	--	4.9	5	100	2000	10	
--	--	--	1.9	L	100	2000	7	
			West of Taylor Lake--Continued					
15.5	1.22	40.7	--	--	--	--	--	Hornblende pyroxenite with magnetite.
75.1	.62	2.8	8.2	--	--	--	--	Do.
10.1	1.21	44.7	--	--	--	--	--	Do.
--	--	--	--	30	20	20	7	Do.

TABLE 21.—*Assay data, Holkham Bay prospect*

Sample number	Sample type	Length		Semiquantitative spectrographic analysis (ppm)	Atomic absorption (ppm)		Fire assay (ppm)		Description
		Ft	(m)	Ag	Au	Pb	Au	Ag	
Vein #1, surface exposure									
3K116	Channel.	1.5	(0.5)	N	N	L	--	--	Iron-stained quartz vein.
3K117	--do.--	1.6	(.5)	N	.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.	.6	(.2)	.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	.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	.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	.3	Sheared zone with 1.8-ft-thick quartz vein.

Vein #2, surface exposure									
3K146	Channel.	7.0	(2.1)	.5	.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	7.2	L	Do.
3K158	--do.--	6.1	(1.9)	N	L	20	--	--	Do.
Vein #3 extension, surface exposure									
3K159	Channel.	10.7	(3.3)	.5	N	30	--	--	Quartz vein.
3K160	--do.--	9.0	(2.7)	N	.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)	.7	.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.

TABLE 22..—*Assay data, Placer workings in the first basin of Spruce Creek*

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

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

TABLE 23.—*Assay data, Sumdum Chief mine area*

Sample number	Sample type	Length		Semiquantitative spectrographic analysis (ppm)		Atomic absorption (ppm)			Fire assay (ppm)		Description
		Ft	(m)	Ag	Mo	Au	Pb	Zn	Au	Ag	
					Sumdum Chief stope						
[1]4S365	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 partings.
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----	.8	(.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	.10	15	120	N	.02	
4K204	--do.------	--	--	1	N	N	15	120	N	N	
4K205	Stream sediment, panned concentrate.	--	--	1.5	N	.40	30	200	.3	L	
4K206	Channel----	.4	(.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	.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.

TABLE 24.—*Assay results, Taylor Lake area*

Sample number	Sample type	Length		Semiquantitative spectrographic analysis (ppm)		Atomic absorption (ppm)				Fire assay (ppm)		Description
		Ft	(cm)	Ag	Mo	Au	Cu	Pb	Zn	Au	Ag	
						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 footwall 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	.15	35	1300	250	N	20.6	Quartz vein, 2 to 3 feet thick.
4S140	--do.------------	--	--	.5	N	N	5	40	90	--	--	Quartz vein, 3 feet thick.
						Other results--north section						
4S133	Selected grab----	--	--	N	N	N	N	N	5	--	--	Float from 0.5-feet-thick quartz vein.
4S135	--do.------------	--	--	N	N	N	10	5	130	--	--	Quartz from iron-stained schist.

[illegible]	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	--	--	Do.
4S251	Channel----------	.35	(11)	.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 percent of the rock.
4S253	--do.------------	4.0	(122)	L	N	N	20	15	40	--	--	Quartz vein.
4S254	--do.------------	.4	(12)	1	N	N	50	40	100	--	--	Do.
4S255	--do.------------	17.5	(533)	.7	10	N	20	20	85	--	--	Schist with quartz stringers. Quartz comprises about 60 percent of the rock.
4S256	Spaced chip at 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----------	.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	10	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.

TABLE 25.—*Assay data, Lower Sweetheart Lake to Tracy Arm area*

Sample number	Sample type	Length		Semiquantitative spectrographic analysis (ppm)		Atomic absorption (ppm)			Description
		Ft	(m)	Ag	Au	Cu	Pb	Zn	
				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 south side of lake.
4K305	--do.------------	--	--	N	N	30	5	20	Tributary 1/4 mile up lake on south 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)	.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.------------	.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.
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 silified schist and gneiss.
5S005	Spaced chip, 0.25-ft interval.	13	(4.1)	N	.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

[1]3K169	Chip-------------	2.5	(.8)	1.5	.10	70	70	130	Quartz vein with abundant pyrite and sericite.
3K170	Channel----------	.4	(.1)	L	N	10	L	15	Quartz vein with minor pyrite.
[2]3K171	Selected grab----	--	--	.5	7.0	40	950	75	Quartz vein float with arseno-pyrite.
3K172	Spaced chip, 1-ft interval.	170	(32.6)	.5	N	65	10	90	Rusty-weathering schist.
3K173	Chip-------------	.2	(.06)	.5	N	65	30	70	Quartz vein.

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.

[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 26.—*Assay data, Sweetheart Ridge prospect*

	Sample number	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	[illegible]b	--do.-------	--	--	N	N	N	210	15	60	--	--	
3	[illegible]a	Channel-----	1.2	(.4)	10	N	.80	1700	25	220	N	7.9	Gneiss with pyrite and chalcopyrite.
4	[illegible]b	--do.-------	1.5	(.5)	5	N	.40	11000	20	120	N	10.3	Do.
5	[illegible]c	Chip--------	6.0	(1.8)	N	N	N	120	15	55	N	5.1	Do.
6	[illegible]a	--do.-------	4.0	(1.2)	3	N	.60	4700	20	75	N	.7	Gneiss with sulfides.
7	[illegible]b	--do.-------	4.0	(1.2)	2	N	.10	2300	25	100	N	9.6	Do.
8	[illegible]a	--do.-------	.6	(.2)	N	N	N	380	10	25	N	1.4	Do.
9	[illegible]a	--do.-------	2.2	(.7)	.7	N	N	1500	10	25	N	1.4	Do.
10	[illegible]c	--do.-------	1.7	(.5)	10	N	.60	20000	10	170	N	N	Do.
11	[illegible]d	--do.-------	2.2	(.7)	5	N	.90	2500	10	60	N	3.8	
12	[illegible]	--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	Do.
20	5S268IIc	--do.-------	.6	(.2)	7	10	.20	2000	30	50	N	6.5	Limonite-stained gneiss. Sulfides leached out.
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 percent 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	--do.-------	1.9	(.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	.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.
47	5S253a	--do.-------	5.0	(1.5)	7	30	3.5	2200	630	1500	N	4.8	Do.
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 percent 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.
[2]53	5S257	Soil sample.	--	--	N	N	.05	35	40	15	--	--	6 ft west of gold-bearing quartzose gneiss.
54	7b	--do.-------	--	--	N	N	.60	40	40	25	--	--	4 ft west of gold-bearing quartzose gneiss.
55	7c	--do.-------	--	--	N	N	--	60	35	30	--	--	In gold-bearing quartzose gneiss.
56	7d	--do.-------	--	--	N	L	.10	180	35	20	--	--	Do.
57	7e	--do.-------	--	--	N	L	.15	450	50	55	--	--	Do.
58	7f	--do.-------	--	--	.5	N	.40	510	160	70	--	--	Do.
59	7g	--do.-------	--	--	N	N	.15	380	240	55	--	--	Do.
60	7h	--do.-------	--	--	N	N	.05	200	55	110	--	--	2 ft east of gold-bearing quartzose gneiss.
61	7i	--do.-------	--	--	N	N	.05	370	15	30	--	--	4 ft east of gold-bearing quartzose gneiss.
62	2	Chip--------	6.8	(2.1)	N	N	N	30	5	35	--	--	Gneiss.
63	1	--do.-------	4.6	(1.4)	N	N	N	5	5	20	--	--	Slightly iron-stained gneiss.
64	7	Channel-----	5.1	(1.6)	1	N	N	260	5	15	--	--	Quartz fragments and gneiss in lenticular structure (about 6 percent 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 gneiss with pyrite and chalcopyrite.
67	5S068	--do.-------	4.6	(1.4)	L	N	.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 quartoze gneiss.
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.
[2]69	5S074	Chip--------	5.4	(1.6)	50	70	11	9300	2300	5200	5.2	4.5	Intensely iron-stained cataclastic quartzose gneiss.
[2]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	5S285e	--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.

[1]Refer to figures 60-63.

[2]Samples 53-61, 70-76, and 97-106 were taken at 2-ft intervals, on lines normal to altered zone.

TABLE 26.—Continued

	Sample number	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--Continued							
79	5R008b	Chip--------	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	Gneiss with quartz lenses, quartzite band and chalcopyrite.
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.
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	Do.
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 and 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 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	--do.------	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.
[2]97	5S259a	Soil sample.	--	--	1	N	.20	260	190	140	--	--	8 ft west of gold-bearing quartzose gneiss.
98	b	--do.-------	--	--	.7	N	N	230	160	130	--	--	6 ft west of gold-bearing quartzose gneiss.
99	c	--do.-------	--	--	N	N	N	180	90	95	--	--	4 ft west of gold-bearing quartzose gneiss.
100	d	--do.-------	--	--	N	N	N	200	110	95	--	--	2 ft west of gold-bearing quartzose gneiss.
101	e	--do.-------	--	--	N	N	N	200	90	95	--	--	In quartzose gneiss.
102	f	--do.-------	--	--	N	N	N	230	130	100	--	--	Do.
103	g	--do.-------	--	--	.7	N	N	360	170	140	--	--	Do.
104	h	--do.-------	--	--	.5	N	.10	310	140	110	--	--	2 ft east of gold-bearing quartzose gneiss.
105	i	--do.-------	--	--	.7	N	.10	250	120	90	--	--	4 ft east of gold-bearing quartzose gneiss.
106	j	--do.-------	--	--	N	N	.10	250	130	70	--	--	6 ft east of gold-bearing quartzose gneiss.
107		Channel-----	5.6	(1.7)	100	50	7.0	8400	5900	19000	6.0	5.1	Intensely iron-stained cataclastic quartzose gneiss.
108		Chip--------	1.7	(.5)	N	N	N	50	5	10	N	7.2	Gneiss with sulfides.
109		Channel-----	6.0	(1.8)	N	N	.10	150	65	80	N	.3	Moderately iron-stained gneiss.
110		Chip--------	5.0	(1.5)	7	N	.05	3500	10	25	N	N	Do.
111		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.
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 the mineralized zone and the summit of peak 3405

4S273	Channel-----	.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)	L	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.

Other investigations--mineralized zone 400 feet west

5S250	--do.-------	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.

TABLE 26.—Continued

Sample number	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												
5S279	Spaced chip @ 0.25 ft interval.	5.5	(1.7)	.5	N	N	140	20	60	N	5.5	Gneiss with sulfides.
5S280	--do.-------	5.5	(1.7)	.5	N	N	90	5	40	N	.3	Iron-stained gneiss with gneiss.
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												
5S282	Spaced chip @ 0.5 ft interval.	15	(4.6)	L	N	N	140	10	45	N	.3	Gneiss with finely dissiminated pyrite and chalcopyrite.

TABLE 27.—*Assay data, Tracy Arm zinc-copper prospect*

Sample number	Pit no.	Sample type	Length		Semiquantitative spectrographic analysis (ppm)				Atomic absorption (ppm)			Fire assay (ppm)		Description
			Ft	(m)	Ag	Mo	Cd	Au	Cu	Pb	Zn	Au	Ag	
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.
3K183	11	--do.--	2.1	(.6)	70	10	150	2.5	23000	30	21000	.7	13.0	Schist with banded 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 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	.3	10.0	Banded 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, and sphalerite.
3P140	17	--do.--	3.9	(1.2)	2	7	150	.30	18000	20	43000	1.0	17.1	Alaskite and schist with banded and disseminated pyrite, chalco-pyrite, and sphalerite.
3P141	17	--do.--	1.6	(.5)	15	20	200	N	3400	15	20000	--	--	Gneiss and banded sulfides.
3P142	17	--do.--	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 pyrrho-tite, pyrite, chalcopyrite, and sphalerite.
3P144	19	--do.--	10.1	(3.1)	3	10	200	.15	8000	30	32000	--	--	Gneiss and banded mineralization with pyrrhotite, pyrite, chalco-pyrite and sphalerite.
3P145	20	--do.--	6.5	(2.0)	5	15	200	.50	15000	25	30000	N	N	Banded 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.

TABLE 28.—*Assay data, Sumdum Glacier mineral belt between Sumdum copper-zinc prospect and Tracy Arm*

Sample number	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	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, 1-3/4-in. 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	(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	Do.
4S291	Spaced chip, 2-ft interval.	15	(4.6)	N	N	60	10	30	Do.
4S292	Spaced chip, 0.25-ft interval.	13	(4.0)	N	L	35	5	25	Do.
4S293	Spaced chip, 0.5-ft interval.	8	(2.4)	.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	--do.-------------	150	(45.7)	N	N	40	L	30	Do.
				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)	.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.—Continued

Sample number	Sample type	Length		Semiquantitative spectrographic analysis (ppm)		Atomic absorption (ppm)			Description
		Ft	(m)	Ag	Mo	Cu	Pb	Zn	
				Area D					
4S333	Spaced chip, 2-ft interval.	20	(6.1)	L	N	15	5	40	Gneiss with disseminated sulfides.
[1]4S334	Spaced chip, 1-ft interval.	8	(2.4)	L	N	55	5	95	Gneiss.
4S335	--do.-------------	26	(7.9)	.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					
[2]4S350	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.
[2]4S355	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.
4S361	--do.-------------	31	(9.4)	N	N	5	5	30	Do.
4S362	--do.-------------	19	(5.8)	N	N	5	5	25	Do.
4S363	--do.-------------	31	(9.4)	.5	N	5	10	45	Do.
4S364	Channel-----------	.8	(.2)	30	N	L	230	45	

[1]Atomic absorption gave 0.10 ppm Au.
[2]Atomic absorption gave L for Au.

TABLE 29.—*Assay data, Sumdum copper-zinc prospect*

Sample number	Sample type	Length		Semiquantitative spectrographic analysis (ppm)		Atomic absorption (ppm)				Fire assay (ppm)		Description
		Ft	(m)	Ag	Mo	Au	Cu	Pb	Zn	Au	Ag	
						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	.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	35	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						
[1]4K192	Spaced chip, 1-ft interval.	75	(22.9)	.7	N	N	30	10	60	--	--	Hornfels.
4K193	--do.---------------------	75	(22.9)	L	N	N	25	10	90	--	--	Do.
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.
[1]4K197	Spaced chip, 1-ft interval.	60	(18.3)	2	N	N	150	320	180	--	--	Gneiss.
4K198	--do.---------------------	55	(16.8)	3	N	N	290	400	370	--	--	Do.
4K199	Channel-------------------	.8	(.2)	7	N	.10	7000	310	65000	N	11.3	Pyrrhotite and chalcopyrite.
4K221	--do.---------------------	3.0	(.9)	10	N	.05	12000	25	2500	--	--	Massive phyrrhotite with chalcopyrite and sphalerite.
4K222	--do.---------------------	1.8	(.5)	10	30	.10	2300	90	1400	--	--	Hanging wall of pyrrhotite zone.
4K223	--do.---------------------	.4	(.1)	15	N	.10	5900	65	42000	--	--	Pyrrhotite zone.
4K224	--do.---------------------	1.2	(.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	(.9)	10	N	.10	2700	25	390	--	--	Gossan.
4K227	--do.---------------------	.9	(.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	(.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	(.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.
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.
[2]4K235	Channel-------------------	10.0	(3.0)	10	N	1.5	7800	900	21000	N	22.6	Gneiss with pyrrhotite, chalcopyrite and sphalerite.
4K236	--do.---------------------	10.0	(3.0)	2	N	.10	710	35	280	--	--	Gneiss with pyrrhotite.
4K237	--do.---------------------	10.0	(3.0)	.7	N	L	650	35	120	--	--	Crenulated schist with pyrite.
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)	.5	N	L	300	15	100	--	--	Gneiss.
[2]4K249	Channel-------------------	10.0	(3.0)	5	N	.15	1000	130	4200	N	10.3	Pyrite pod.
4K250	--do.---------------------	10.0	(3.0)	3	N	.05	980	210	310	--	--	Gneiss.
4K251	--do.---------------------	10.0	(3.0)	7	N	.30	3500	150	5400	--	--	Do.
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.
Southeast of no. 5 area												
[2]4K259	Spaced chip, 1-ft interval.	75	(22.9)	.5	N	N	480	100	1800	--	--	Rusty schist and gneiss with minor sulfides. Projection of ore zone probably west under snow.
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.
4K263	--do.---------------------	70	(21.0)	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.
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.
4K268	--do.---------------------	14	(4.3)	N	N	N	25	25	45	--	--	Do.
4S375	--do.---------------------	65	(19.8)	N	N	N	35	20	70	--	--	Stained schist.
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.

[1]Sample numbers 4K192, and 4K193, 4K197 and 4K198 in the no. 3 area are both continuous sections.

[2]Sample numbers 4K235 to 4K240, 4K249 to 4K250, and 4K251 to 4K258 in the no. 5 area and samples 4K259 to 4K261, 4K262 to 4K264, 4K265 to 4K266, and 4K267 to 4K268 in the southeast of no. 5 area are continuous sections.

TABLE 30.—*Assay data, Powers Creek stained zone*

Sample number	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	All are iron-stained siliceous phyllite with occasional disseminated pyrrhotite, traces of chalcopyrite and discontinous 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	95	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	

TABLE 31.—*Assay data, Portland prospect*

Sample number		Sample type	Length		Semiquantitative spectrographic analysis (ppm)	Atomic absorption (ppm)			Description
			Ft	(m)	Ag	Cu	Pb	Zn	
Intermediate length adit									
[1]1	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	2K161	--do.---	19.0	(5.8)	N	10	10	10	Thin band of iron.
7	2K162	--do.---	.5	(.15)	N	10	35	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.
[2]13	2K145	--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									
[2]11	2K163	Chip----	8.0	(2.4)	10	930	1800	3400	Thin band of iron.
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.

[1]Refer to figure 71.
[2]Atomic absorption gave 0.10 ppm Au.

TABLE 32.—*Assay data, Sulphide prospect*

Sample number	Sample type	Length		Trench number	Semiquantitative spectrographic analysis (ppm)		Atomic absorption (ppm)				Fire assay (ppm)		Description
		Ft	(m)		Au	As	Au	Cu	Pb	Zn	Au	Ag	
3P002	Channel	5	(1.5)	1	10	300	N	1000	2000	3500	--	--	All are fine-
3P003	--do.--	6.5	(2.0)	1	10	5000	.10	870	3200	6000	--	--	grained light-
3P004	--do.--	4.5	(1.4)	1	1	2000	N	360	900	1500	--	--	colored contorted
3P005	--do.--	5.5	(1.7)	1	30	1500	L	1000	13000	17500	N	43.9	rusty gneiss and
3P006	--do.--	5.5	(1.7)	1	5	3000	N	480	3300	5200	--	--	quartzite sulfide
3P007	--do.--	5.5	(1.7)	2	7	2000	N	830	4700	7400	--	--	bands and lenses
3P008	--do.--	5	(1.5)	2	10	2000	.15	2500	6500	14000	--	--	parallel to folia-
3P009	--do.--	5.5	(1.7)	2	5	2000	.10	400	2000	4000	N	.3	tion. Bands range
3P010	--do.--	6.1	(1.9)	2	3	2000	N	300	1800	2800	--	--	up to 0.4 feet
3P011	--do.--	4.4	(1.3)	2	20	1000	.10	1600	7600	19000	N	2.1	thick and contain
3P012	--do.--	5.3	(1.6)	4	.5	1500	N	170	85	185	--	--	iron sulfides with
3P013	--do.--	4.8	(1.5)	4	10	2000	.15	2200	9400	14000	N	17.1	lesser sphalerite,
3P014	--do.--	5	(1.5)	4	3	3000	.05	430	2900	5200	--	--	chalcopyrite,
3P015	--do.--	6.4	(2.0)	4	1	1500	N	300	750	600	--	--	galena and
3P016	--do.--	7	(2.1)	4	3	10000	.05	450	3600	6400	--	--	arsenopyrite.
3P017	--do.--	7	(2.1)	4	7	G10000	.05	750	9500	12500	--	--	Sulfides tend to
3P018	--do.--	6	(1.8)	4	.7	7000	L	100	700	650	--	--	concentrate in
3P019	--do.--	5.5	(1.7)	4	N	N	N	5	25	50	--	--	in small fold
3P090	--do.--	5	(1.5)	5	5	2000	.15	1200	2200	8600	--	--	axes.
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	--	--	

TABLE 33.—*Assay data, Powers Creek placers*

Sample	Oz/cu yd[1]	Sample	Oz/cu yd[1]
3K001	0.0003	3K008	0.0002
3K002	N	3K009	.0031
3K003	.0004	3K010	.0005
3K004	.0004	3K011	.0002
3K005	N	3K012	.0004
3K006	N	3K013	.0001
3K007	N		

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

TABLE 34.—*Assay data, Fords Terror area*

Sample number	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	(.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	(.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.

TABLE 35.—*Assay data, Whiting River silver-gold prospect*

Sample number	Sample type	Length		Semiquantitative spectrographic analysis (ppm)		Atomic absorption (ppm)				Fire assay (ppm)		Description
		Ft	cm	Ag	As	Au	Cu	Pb	Zn	Au	Ag	
						Open cut						
4S015	Channel	0.5	15	L	N	N	20	90	200	--	--	Limestone.
4S016	--do.--	.75	23	N	N	N	100	30	190	--	--	Tactite.
4S017	--do.--	1.25	38	N	N	N	20	75	260	--	--	Limestone.
4S018	--do.--	2.5	76	15	1500	.05	110	1200	340	N	13.0	Quartz vein.
4S019	--do.--	1.1	34	200	G10000	7.5	530	18000	7900	7.5	393.5	Quartz vein with sulfide band.
4S020	--do.--	.9	27	15	1500	.25	1500	3600	2400	N	11.7	Dolomite limestone.
4S021	Chip---	1.0	30	300	G10000	26.0	410	24000	11000	56.9	1076.7	Quartz vein with sulfide band.
4S022	--do.--	4.0	122	15	7000	.25	150	2600	4800	1.0	54.5	Limestone with quartz with sulfides.
4S023	--do.--	2.7	82	200	G10000	3.5	640	26000	1600	3.6	189.2	Do.
4S024	Channel	2.5	76	150	1500	.05	980	22000	3300	3.8	88.4	Quartz vein.
4S433	--do.--	1.1	34	300	G10000	31.0	320	15000	17000	10.3	319.8	Replicate of 4S019.
4S434	Chip---	1.0	30	1000	G10000	7.0	520	12000	6500	8.6	1807.9	Replicate of 4S021.
4S435	Channel	2.5	76	500	5000	2.5	1700	50000	15000	3.1	793.2	Replicate of 4S024.
4S436	Chip---	1.2	37	7	G10000	1.0	100	700	740	--	--	Limestone with quartz with sulfides.
5S002	Channel	1.4	43	1000	G10000	14	3700	46000	14000	15.5	992.4	Quartz vein with sulfide band containing pyrite, galena and some chalcopyrite.
5S003	--do.--	.9	27	1000	G10000	34	90	35000	920	22.7	878.9	Replicate of 4S021.
5S004	Chip---	2.9	88	150	5000	48	180	13000	510	.8	73.7	Replicate of 4S022.
				Sulfide-bearing quartz vein 70 feet southeast of the open cut								
4S437	Chip---	3.0	91	20	500	.60	130	1000	440	--	--	Quartz vein.
4S454	Channel	1.9	58	7	N	N	55	250	260	--	--	Do.
4S455	--do.--	1.8	55	1	N	N	45	150	150	--	--	Do.
4S456	--do.--	2.4	73	15	N	L	50	630	40	--	--	Do.
						Crosscut						
4S429	Chip---	6.0	183	N	N	N	45	10	55	--	--	Amphibolite with albite and mica.
4S430	Spaced chip, 0.25-ft interval.	12	366	N	N	N	85	20	75	--	--	Iron-stained gouge zone.
4S431	Channel	.1	3	3	500	N	15	470	150	--	--	Quartz vein.
						Other sulfide-bearing quartz veins						
4S432	Channel	.2	6	70	700	2.5	4000	18000	11000	--	--	Quartz vein with sulfides.
4S453	--do.--	.1	3	30	N	N	1100	210	15000	--	--	Do.
4S458	--do.--	.8	24	7	N	N	270	5000	10	--	--	Do.

TABLE 36.—*Assay data, iron-stained zones near the International Boundary*

Sample number	Sample type	Length		Semiquantitative spectrographic analysis (ppm)		Atomic absorption (ppm)			Description
		Ft	(m)	Ag	Mo	Cu	Pb	Zn	
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)	.7	7	50	60	50	Do.
4S026	--do.------------	50	(15.2)	.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	
5S036	--do.------------	--	--	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.

TABLE 36.—Continued

Sample number	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-8)								
4K280	Spaced chip, 2-ft interval.	66	(20.1)	N	10	45	L	35	500 + ft stratigraphic
									sample section across
4K281	--do.------------	150	(45.7)	N	L	35	L	35	heavily iron-stained
4K282	--do.------------	150	(45.7)	N	15	30	L	30	biotite gneiss with
4K283	--do.------------	150	(45.7)	N	L	30	L	30	traces of disseminated
4K284	Composite grab---	200	(61)	N	N	75	5	50	pyrrhotite.
	Stained zones near the Sawyer Glaciers (location S-9)								
4K309	Spaced chip, 4- to 5-ft interval.	2500 feet		N	15	50	15	60	Heavily iron-stained biotite gneiss with an occasional trace of
4K310	--do.------------			N	10	60	35	60	pyrite. Some small
4K311	--do.------------	(762 m)		N	10	55	10	65	unstained irregular
4K312	--do.------------			N	7	45	15	55	masses of granite.
4K313	--do.------------	total length		N	15	50	5	60	
4K314	--do.------------			N	20	65	5	45	
4K315	--do.------------	across		N	7	35	5	45	
4K316	--do.------------			N	15	70	5	50	
4K317	--do.------------	structure		N	L	55	5	55	
4K318	--do.------------			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.
[1]4S449	--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.
	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	(91.1)	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.

TABLE 37.—*Assay data, Meigs Peak gold-zinc anomaly*

Sample number	Sample type	Length		Semiquantitative spectrographic analysis (ppm)	Atomic absorption (ppm)				Description
		Ft	(cm)	Ag	Au	Cu	Pb	Zn	
5S007	Stream sediment--	--	--	0.7	N	110	15	140	
5S008	Channel----------	.3	(9)	N	N	110	140	30	Schist with disseminated sulfides.
5S009	Stream sediment--	--	--	.7	N	120	10	160	
5S010	--do.------------	--	--	.5	N	40	10	320	
5S011	Selected grab----	--	--	N	N	25	10	75	Iron-stained quartz vein.
5S012	Stream sediment--	--	--	.5	.15	70	15	260	
5S013	--do.------------	--	--	N	N	100	20	120	
5S014	--do.------------	--	--	.7	N	65	10	300	
5S015	--do.------------	--	--	N	N	140	15	400	
5S016	--do.------------	--	--	.5	N	75	10	260	
5S017	--do.------------	--	--	N	N	130	15	380	
5S018	--do.------------	--	--	.5	N	85	10	280	
5S019	--do.------------	--	--	N	.7	120	10	230	
5S020	--do.------------	--	--	L	N	120	15	230	
5S021	--do.------------	--	--	L	N	90	10	240	
5S022	--do.------------	--	--	.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	

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