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report of investigations 6587

TIN-LODE INVESTIGATIONS, POTATO MOUNTAIN AREA, SEWARD PENINSULA, ALASKA

By John J. Mulligan

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

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CONTENTS

CONTENTS (Con.)

ILLUSTRATIONS

ILLUSTRATIONS (Con.)

TABLES

TIN-LODE INVESTIGATIONS, POTATO MOUNTAIN AREA, SEWARD PENINSULA, ALASKA

by

John J. Mulligan[1]

With Section on Petrography by Walter L. Gnagy

ABSTRACT

The Bureau of Mines investigated lode tin deposits on Potato Mountain, Seward Peninsula, Alaska. Tin was found to occur as cassiterite associated with quartz, tourmaline, pyrite, arsenopyrite, and earthy clays, but the deposits lack the varied accessory minerals commonly found in tin districts. The tin-bearing deposits are in metasediments along minor breaks and bedding planes but not in the crushed earthy filling of major faults. Cassiterite and sulfides occur with quartz in veins, both with and without earthy clays, and disseminated through tourmalinized wall rocks. The deposits are characterized by irregular segregations containing 1 to 10 percent tin within zones averaging not over 0.25 percent tin. The largest segregation exposed is on the summit of a low hill on the east-central slopes of Little Potato Mountain; most of the outcroppings are in an area trending east to west, roughly 10 to 30 feet wide and 300 feet long. Sample values ranged as high as 12 percent tin, but the average grade may be about 1 percent tin. The extreme irregularity of both grade and composition precludes a more exact determination. Similar concentrations are scattered for over 1,000 feet to the west and north, but these are smaller and lower in grade. Elsewhere on Potato Mountain, generally similar deposits occur as clusters of veinlets at widely separated points in the metasedimentary walls of major faults.

INTRODUCTION

The Bureau of Mines has been investigating lode and placer tin deposits in the western Seward Peninsula, Alaska (fig. 1) intermittently since 1941. The Cape Mountain, Brooks Mountain (Lost River), Ear Mountain, Potato Mountain, and York areas have been investigated, and the results have been presented in Bureau of Mines publications (<u>27</u>-<u>34</u>).[2]

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[1] Mine examination and exploration engineer, Area VIII Mineral Resource Office, Bureau of Mines, Juneau, Alaska.

[2] Underlined numbers in parentheses refer to items in the bibliography at the end of this report.

Work on manuscript completed February 1964.

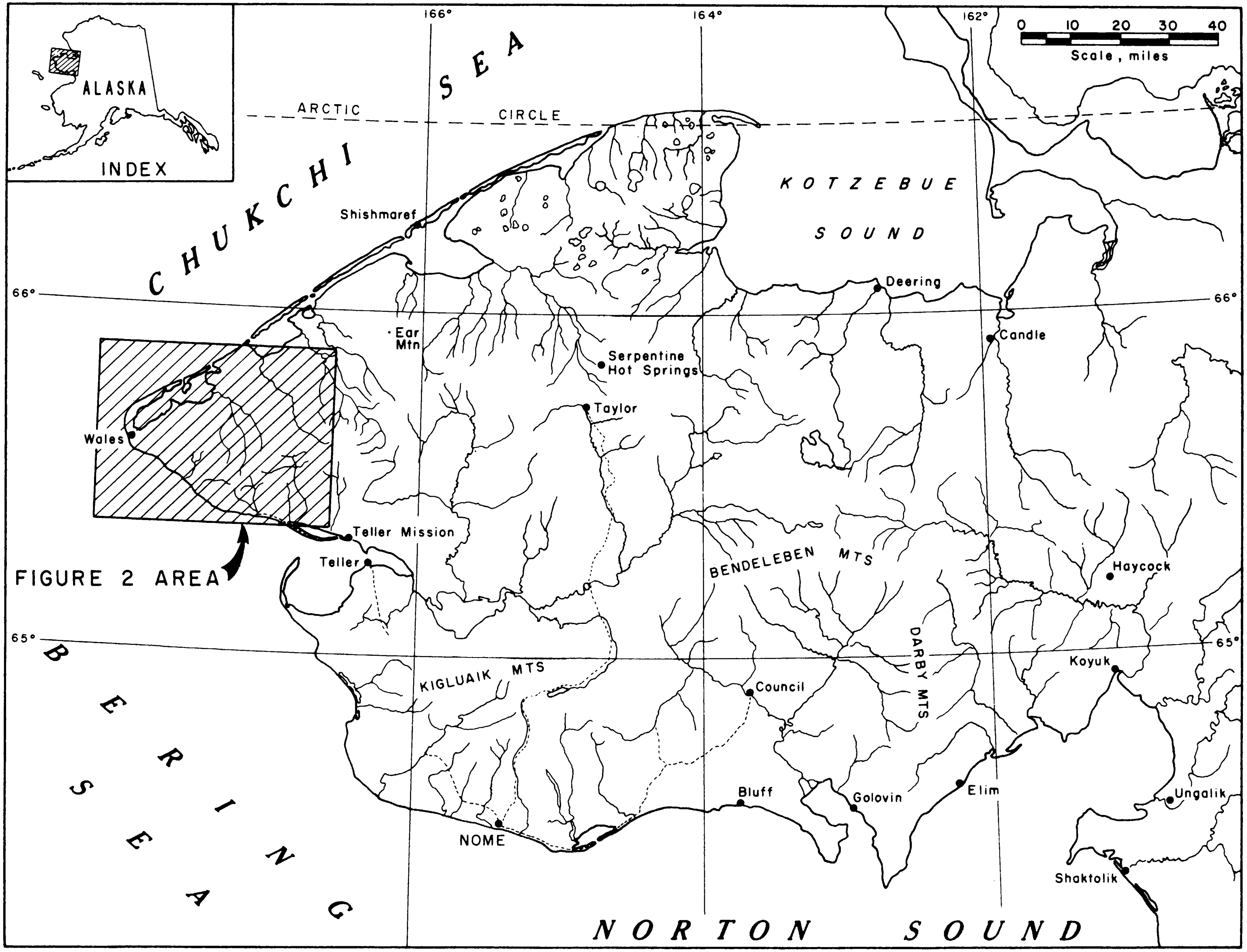

FIGURE 1. - Seward Peninsula, Alaska.

This report of an investigation of lode tin deposits in the Potato Mountain area includes an account of the work done, a description of the deposits, chemical and petrographic analyses made at the Bureau of Mines, Area VIII Mineral Resource Office, Juneau, Alaska, and spectrographic analyses made at the Bureau of Mines, Albany Metallurgy Research Center, Albany, Oreg. The lode outcroppings were delineated by systematically sampling the placer gravels and the frost-broken detritus that blanket the area. Therefore, this report also summarizes the distribution of placer tin deposits and includes a description of the detrital overburden and the methods used to delineate the lode outcroppings.

ACKNOWLEDGMENTS

Historical notes and general geological data were compiled principally from the Bureau of Mines and Geological Survey publications listed in the bibliography. Figure 1, in this report, is based on the Army Map Service 1:1,000,000 series map entitled Nome. Figure 2 is based on plate 1 of Geological Survey Bulletin 733. Figures 3 and 6 are based on the Teller (C-6) Alaska topographic map made by the Army Map Service but published and distributed by the Geological Survey. The chief modifications were adding or identifying features, trails, and prospects mentioned in the text and omitting data not pertinent to this report.

The personnel of the Nome station of the Alaska Communications System and Mrs. Helen Blodgett, who operated a cooperating radio station at Teller, maintained daily radio schedules with the field party that saved much time in the transmission of reports and orders, and provided a means of summoning assistance in case of emergency.

LOCATION AND ACCESSIBILITY

Potato Mountain is about 60 miles south of the Arctic Circle and 100 miles N 38° W of Nome at latitude 65°39' N and longitude 167°33' W (fig. 1). The Potato Mountain area is uninhabited; the nearest inhabited villages are Wales, about 15 miles to the west-southwest; Teller Mission and Teller, about 40 miles to the southeast; and Shishmaref, about 60 miles to the northeast. Tin City, 13 miles to the southwest (fig. 2), is the site of a small military installation; York, about 12 miles to the south-southwest, has been uninhabited for many years; Lost River, about 20 miles to the southeast, is the site of a lode tin mine. A couple of small dilapidated cabins at York and a half dozen light frame cabins on the bank of Buck Creek about a mile east of Potato Mountain are the only structures in the area between Tin City and Lost River.

The Potato Mountain area is readily accessible by plane from Nome, the center of air traffic for the Seward Peninsula. The principal airfield near the Potato Mountain area is at Tin City; this field has been used by commercial planes such as the DC-3 and military planes such as the C-46. An airfield suitable for bush planes carrying payloads of 1,000 pounds or less is on the northeast flank of Potato Mountain (fig. 2). Another airfield about 3 miles southeast of Potato Mountain at the intersection of Buck Creek and Grouse Creek was used occasionally, but floods eroded the runway making it unsafe for any except the lightest planes.

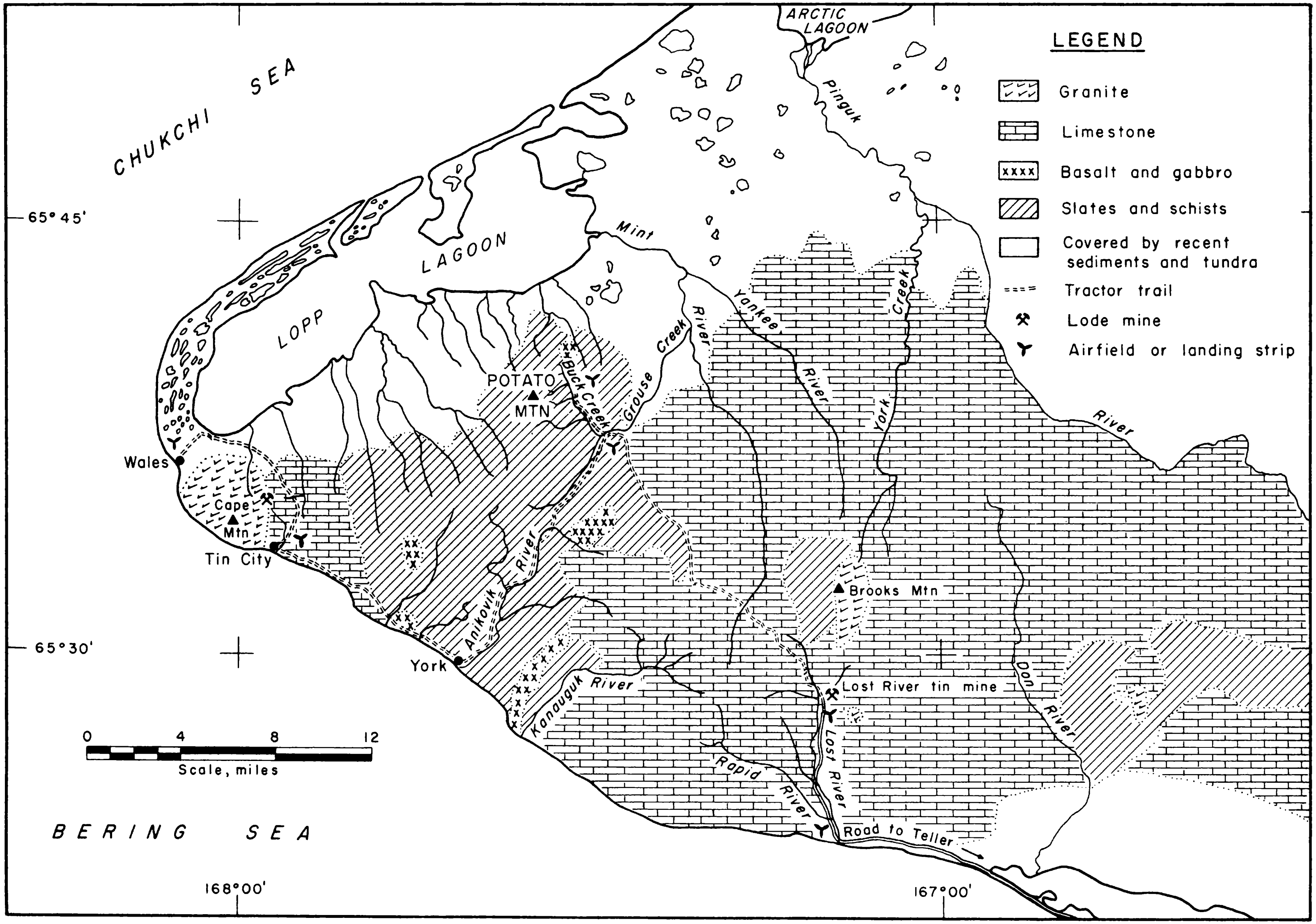

FIGURE 2. - Location and General Geology, Western Seward Peninsula Tin Belt. (Modified from Geological Survey maps.)

Freight too heavy or bulky for air transport is shipped by barge from Nome or lightered ashore from steamships. Nome is the principal port of call for ships that service the Seward Peninsula. Three steamships per year bring cargo to Nome and the Bering Sea ports; the first normally arrives in late June; the last departs in late October. There are no ports on the Seward Peninsula where ships discharge directly. The ships anchor offshore and discharge into lighters. Barges of 50 to 150 tons burden, towed by small tugs, are used both for lightering and for coastwise shipping. Oil shipments are handled by dealers in Nome and distributed either in bulk or by the barrel. A sandy beach at York is the most convenient landing place to the Potato Mountain area. No freight handling facilities of any sort are available; barges or other landing craft are beached and unloaded on the sand. Obviously, such operations require favorable weather.

There are few roads or trails in the Potato Mountain area. An access road extends from Teller to Lost River. A trail from Lost River to Potato Mountain, York, and Tin City (fig. 2) has been used by horse and wagon and by tractors, but would require substantial preparation to be practical for use by trucks. During most of the summer, except during occasional brief floods, off-highway-type trucks can travel along many of the streambeds with little or no preliminary road work. Such vehicles usually require prepared trails over the tundra-covered countryside. Heavily loaded standard six-wheel-drive military-type trucks have been driven over the trail from York to the head of Buck Creek.

Crawler-type tractors towing sleds or trailers are the most commonly used overland transportation. Heavy freight normally is hauled in late winter and early spring, but summer travel is practical throughout the area because of the rounded topography, the lack of trees, and the general absence of unfordable streams. In late summer and fall only light loads can be hauled, and skill and local knowledge are required because of the soft marshy conditions resulting from thawing of the detrital cover.

LABOR

Unskilled, semi-skilled, and many types of skilled labor can be obtained from the native Eskimo and resident white population of the Seward Peninsula. Supervisory personnel and some specialized technicians usually must be brought from other localities. Table 1 lists the population of the western part of the Seward Peninsula (fig. 1) as recorded in 1950 and 1960. A very high percentage of the population is available for employment because of the decrease in gold mining and the lack of other industrial development.

TABLE 1. - Population of the western part of the Seward Peninsula

Settlements	1950	1960	Settlements	1950	1960
Diomede................	103	88	Teller..................	160	217
Igloo..................	64	(1)	Teller Mission.........	109	109
Nome...................	1,876	2,316	Wales..................	141	128
Shishmaref.............	194	217	Total............	2,647	3,075

[1] Settlement abandoned.

LIVING CONDITIONS

Throughout northern Alaska the expansion of communication services and air transport facilities has alleviated the disadvantages of isolation. Field parties can communicate by radiotelephone. Repair parts and perishable food can be delivered by bush plane as required. Food, clothing, and many hardware items are stocked by stores in Nome or Teller; both Wales and Shishmaref have small general stores. Supplies or parts not available locally can be ordered by telephone or telegram and obtained by air in a few days from distributors in the larger Alaskan cities or even from the factory.

Light uninsulated houses or tents are adequate and comfortable in summer. A common practice is to mount light cabins or tents on skids so they can be towed about with a tractor as needed. Heating is ordinarily by oil stoves. Water is obtained from streams or ponds.

Sturdy well-insulated houses are essential in winter. Often water can be obtained only by melting snow or ice as streams may be frozen. In the larger communities, water is sold by distributors who make house-to-house deliveries with a tank truck; other companies collect garbage and sewage which are trucked to public dumps for disposal.

PHYSICAL FEATURES

Potato Mountain rises from the northern coastal plain of the Seward Peninsula (fig. 3) to five rounded summits at 1,000 to 1,370 feet that form the northern bastion of a low ridge extending south-southwest to York. The northeast, north, and west sides of the mountain are drained by a number of short streams that flow directly into Lopp Lagoon. The east and southeast sides of the mountain are drained by the headwater tributaries of Buck Creek which flows into Lopp Lagoon via Grouse Creek and the Mint River. Lopp Lagoon empties into the Chukchi Sea, an arm of the Arctic Ocean.

A thick growth of subarctic tundra vegetation extends from sea level to about 800 feet and a gradually thinning growth extends to the mountaintops. There are no trees; sparse groups of willow bushes, up to 4 or 5 feet high, grow in some of the valleys. Underlying the tundra vegetation is a cover of rock detritus, usually 3 to 5 feet thick but occasionally ranging in thickness from a few inches to 20 feet or more. The tundra vegetation and detritus blanket the entire area except for small scattered patches of bedrock exposed on streambanks or near mountaintops.

CLIMATE

The Potato Mountain area is between the Chukchi Sea and the Bering Sea. During the summer the normal temperature range at sea level is from 33° to 50° F. The wind blows persistently, and often is accompanied by fog and drizzling rain or occasionally snow, although the total annual precipitation is low. During the winter persistent winds and consequent drifting snow prevail, but temperatures are more moderate than at inland locations at the same latitude. No weather records have been kept at Potato Mountain. Except that on

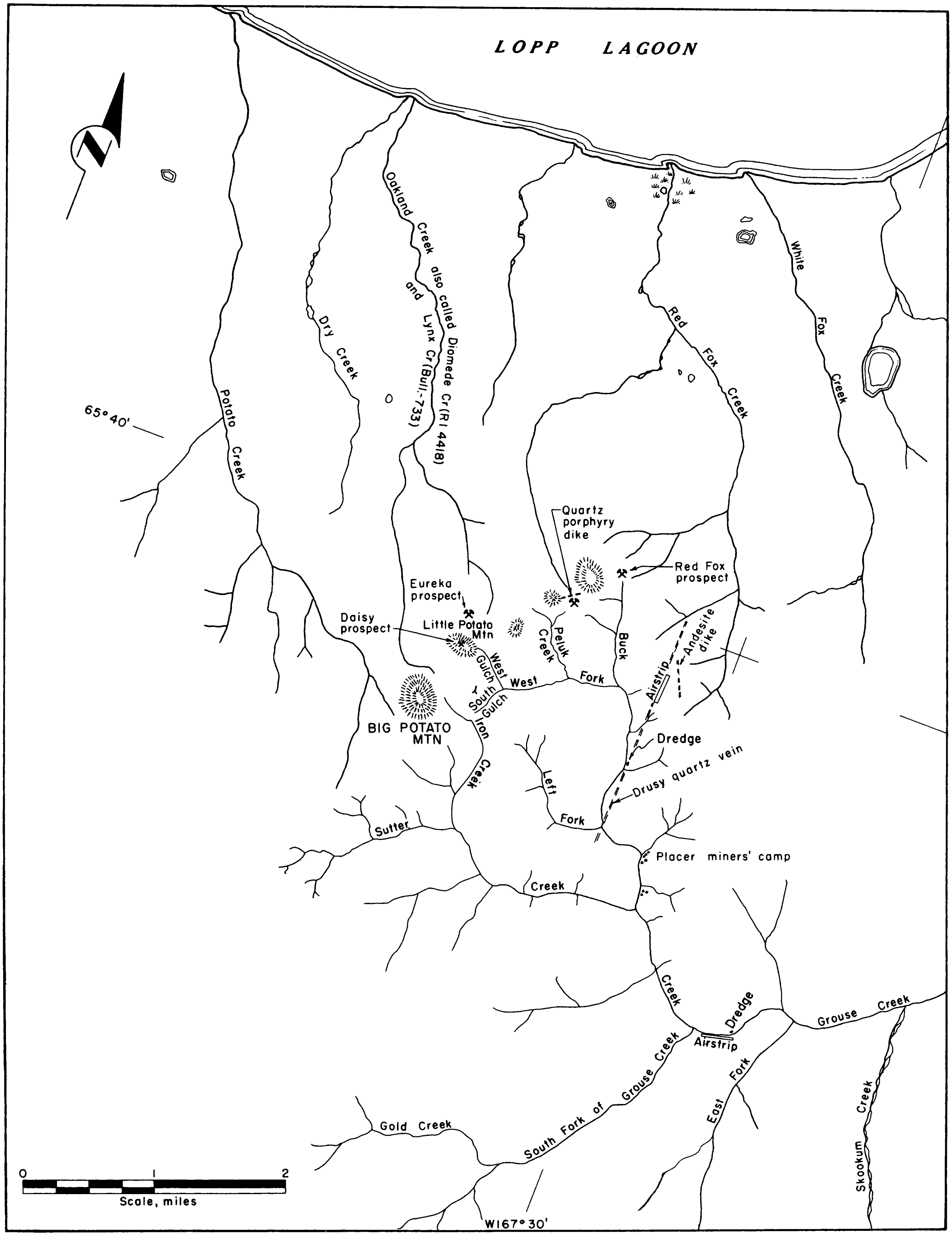

FIGURE 3. - Potato Mountain Area. (Modified from Geological Survey map.)

the mountain rain, wind, and fog may be more prevalent, the climate is similar to that of Wales and Shishmaref for which weather statistics (table 2) were furnished by the Federal Weather Bureau, Anchorage, Alaska.

TABLE 2. - Weather statistics[1]

	Shishmaref	Wales
Average annual temperature............................ ° F	20.2	21.8
Period when average temperature is above 32° F...... months	4	4
Average annual precipitation....................... inches	8.02	11.98
Average annual snowfall..............................do..	32.6	51.7
Prevailing wind direction.................................	North	North
Highest recorded temperature.......................... ° F	78	75
Lowest recorded temperature.......................... ° F	-48	-41

[1] Average breakup:

Bering Strait.......	June 7
Port Clarence.......	June 12
Arctic Ocean........	June 18
Shishmaref Inlet....	June 20

Average freezeup:

Arctic Ocean........	November 6
Port Clarence.......	November 7
Shishmaref Inlet....	November 9
Bering Strait.......	November 29

WATER SUPPLY

The water supply at Potato Mountain during the summer is greater than the low annual rainfall would indicate. Buck Creek and Sutter Creek (fig. 3) did not dry up at any time during the investigation; however, the dredges that operated on Buck Creek (1911 to 1920) were occasionally short of water. Iron Creek and West Fork always carried some water, but at times, only a trickle. Streamflow was not observed during the winter. Because this is a permafrost area, it is probable that all the smaller streams dry up shortly after the ground surface freezes.

Lode mine operators in this area may find it more economical to mine and stockpile ore during the winter and mill it during the summer when water is available. This requires a larger mill, but eliminates the need for weatherproof mill structures and cold weather pumping installations, assuming that water could be found. It also reduces the number of winter employees, thus reducing the housing, transportation, and community services that must be provided.

PROPERTY AND OWNERSHIP

The placer claims listed in table 3 were held by Northern Tin Mining Co. at the time of the investigation and are described in notices of location and grouping on file in the Nome Recorder's Office, Nome, Alaska. The approximate area included in the claims is shown on figure 4. Claim names are not on the map, because no attempt was made to verify either the location or the title. No other placer or lode claims are known in the area.

TABLE 3. - Placer-mining claims in the Potato Mountain area

Claims	Number of claims	Acres (approx.)
No. 1 Association on Iron Creek........................	2	40
No. 2 Association on Iron Creek........................	2	40
Sutter Association on Sutter Creek.....................	8	160
Billy Claim on Sutter Creek............................	1	20
Discovery Claim on Left Fork Creek.....................	1	20
No. 1 Above Discovery Claim on Left Fork Creek.........	1	20
Elma Claim on Left Fork Creek..........................	1	20
Upper Buck Association on Buck Creek...................	2	40
Cub Claim on Buck Creek................................	1	20
Stuart Claim on Buck Creek.............................	1	20
Marvin Claim on Buck Creek.............................	1	20
Whibby Claim on Buck Creek.............................	1	20
Ptarmigan Claim on Buck Creek..........................	1	20
Wild Goose Claim on Buck Creek.........................	1	20
No. 1 Discovery Association on Buck Creek..............	2	40
No. 2 Association on Buck Creek........................	2	40
No. 3 Association on Buck Creek........................	2	40
No. 4 Association on Buck Creek and Grouse Creek........	2	40
No. 5 Association on Grouse Creek......................	2	40
No. 6 Association on Grouse Creek......................	2	40
Fox Claim on Grouse Creek..............................	1	20
No. 1 West Fork Association on West Fork Creek..........	2	40
No. 2 West Fork Association on West Fork Creek..........	2	40
Junction Association on Grouse Creek...................	2	40

HISTORY

Placer Mining

Tin was found in the placer gravels of Buck Creek in the Potato Mountain area in 1901 (figs. 2, 3, and 4). Placer tin production started in 1902 (table 4). Between 1902 and 1911, about 300 tons of concentrate containing about 50 percent tin were produced by manual and small-scale mechanical methods from open placer pits on Buck Creek. In 1911, a double-flume, open-connected bucket-line dredge with a capacity of about 800 cubic yards per day was erected. Starting near the mouth of Sutter Creek, the gravels of Buck Creek were mined upstream reportedly about 6,500 feet and downstream to the mouth of Buck Creek, then down Grouse Creek to the mouth of Left Fork. The gravels mined averaged about 5 or 6 feet deep. Further upstream, the gravels averaged only about 4 feet deep which was too shallow for the dredge. A second dredge, similar except designed for the shallower gravels, was erected in 1915. Using this dredge, Buck Creek was mined upstream almost to the mouth of West Fork. Intermittent small-scale hand-mining operations on Buck Creek and on Iron Creek (a headwater tributary of Sutter Creek) added a few tons to the total production during this period. Tin prices dropped in 1920 and 1921, and all activity stopped; ruins of the dredges remain where they were abandoned.

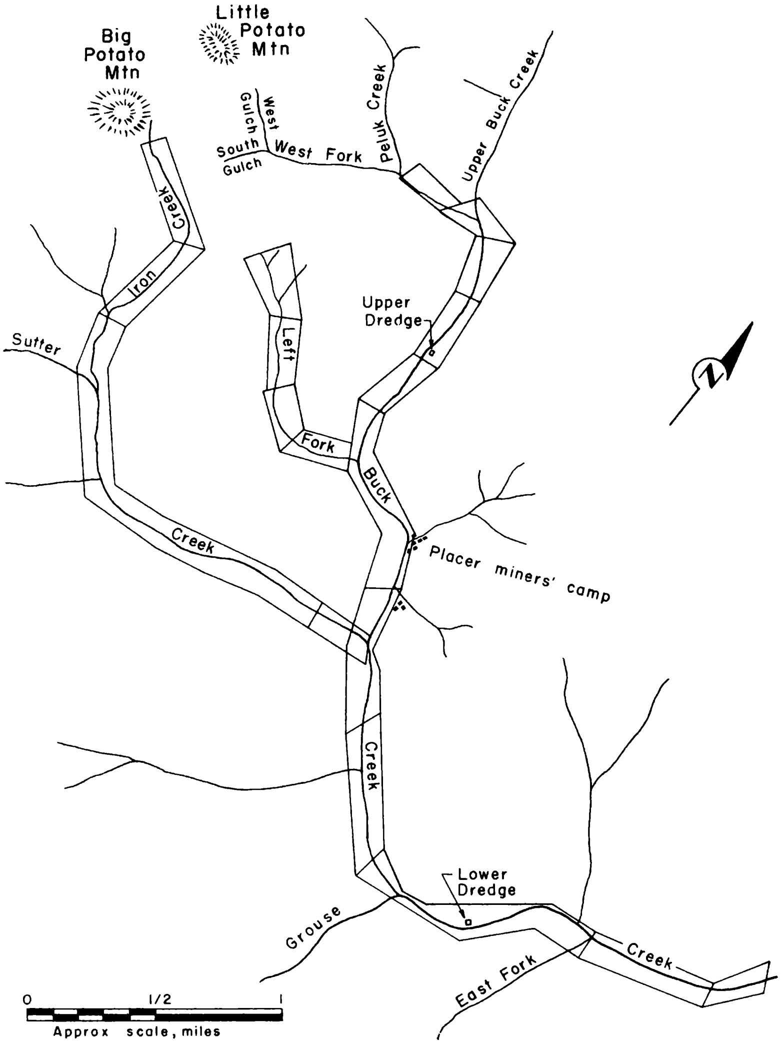

FIGURE 4. - Placer Claims in the Potato Mountain Area.

A gradual rise in tin prices during the late 1930's led to renewed activity in the Potato Mountain area. Prospecting was the principal activity, although about 6 tons of tin were produced in 1937. The threat to the national tin supply caused by the Japanese seizure of Southeast Asia resulted in exploration of the placer reserves by the Bureau of Mines and the U.S. Geological Survey during World War II (30). No production was attempted at that time.

Tin-marketing conditions remained favorable after World War II, and prices tended to increase; placer tin mining was resumed in 1948. The operator used a skid-mounted recovery plant equipped with a trommel screen, jigs, and a tailings stacker belt. Water was pumped to the plant. The gravel was mined with a tractor-dozer and pushed to a dragline that fed the recovery apparatus. The entire plant was moved from place to place as needed. A drop in tin prices, and the uncertain marketing conditions brought about by the closing of the Texas City tin smelter, resulted in a shutdown at the close of the 1953 season. The operation has not been resumed.

Lode Prospecting

Prospectors repeatedly searched the Potato Mountain area for lode tin deposits. Prospect pits and trenches are evident on almost every exposure of quartz. All workings have either sloughed in or filled with ice, and all appear to have been dug prior to 1920. The principal workings are a timbered shaft (Red Fox prospect) near the head of Buck Creek (fig. 3); a timbered shaft on the summit of Little Potato Mountain (Daisy prospect); and a partially timbered adit on the east face of Little Potato Mountain. The various prospects were examined during this investigation, and the results are included in this report. Usually no more than traces or minor amounts of tin were found in the prospect dumps. An exception was two small heaps near the Daisy shaft containing about one-half ton of finely broken tin-bearing quartz that appeared to have been hand sorted from quartz veinlets in shale. No lode tin production has been reported.

TABLE 4. - Production of Potato Mountain area placers[1]

Year	Tin, short tons	Value	Year	Tin, short tons	Value
1902..........	15.0	$8,000	1916..........	97.0	84,600
1903..........	25.0	14,000	1917..........	85.0	104,553
1904..........	14.0	8,000	1918..........	48.0	83,560
1905..........	6.0	4,000	1919..........	36.0	47,182
1906..........	28.0	31,821	1920..........	10.5	10,574
1907..........	22.0	16,752	1937..........	5.95	6,426
1908..........	25.0	15,180	1948..........	4.07	7,975
1909..........	11.0	7,638	1949..........	32.82	64,984
1910..........	10.0	8,335	1950..........	42.00	80,640
1911..........	61.0	52,798	1951..........	52.50	134,400
1912..........	130.0	119,600	1952..........	63.70	152,880
1913..........	48.5	42,780	1953[2].........	55.30	106,176
1914..........	74.0	47,321			
1915..........	100.0	77,300	Total....	1,102.34	1,337,475

[1] This record may be revised slightly as a result of a continuing reexamination of old production records, but is substantially correct.

[2] No production recorded after 1953.

GENERAL GEOLOGY

Bedrock

The predominant rocks in the Potato Mountain area are a series of shales, phyllites, slates, schists, and occasional shaly limestones (fig. 2). In local usage and in previous reports, this series has been referred to collectively as "black-slates." Use of the term will be continued in this report. The black-slates are believed to be of early Paleozoic or pre-Paleozoic age. A series of generally gray limestones overlay the black-slates south and east of the Potato Mountain area, but none were recognized on Potato Mountain. The gray limestones are believed to be principally of Ordovician or Silurian age, although the upper beds may be Mississippian.

Two distinct periods of igneous activity are evident. The first period is represented by mafic stocks, sills, and dikes, locally called greenstones, which intrude the black-slates, but apparently antedate the limestones. Mafic intrusives are an abundant and pervasive feature of the black-slate areas, but only a few prominent outcrops have been mapped. The second period of igneous activity followed the deposition of the limestones; granitic stocks and dikes intruded both the slates and the limestones. The stocks and their associated halo of dikes, veins, and metamorphosed sedimentary rocks are more resistant to erosion than the surrounding sediments and tend to form mountains with an exposed granitic core. Brooks Mountain to the east and Cape Mountain to the west are prominent examples (fig. 2). Potato Mountain is thought to be similar except that erosion has not exposed the granitic core. The apex of an altered granitic (quartz porphyry) dike (fig. 3) is exposed near the northern summits.

A number of large faults and a dense network of minor faults and joints pervade the metasediments. It is not evident whether this breaking took place before, during, or after the granitic intrusion. The major faults are characterized by a filling of crushed wall rock fragments, or crushed zone, ranging from 1 or 2 to 10 or 15 feet in width. Some of these faults were traced for thousands of feet.

Tin-Bearing Deposits

Tin occurs as cassiterite (SnO_2) either associated with quartz in veinlets or veins, or as disseminated minute crystals in tourmaline schists. Pyrite and arsenopyrite occur with most of the quartz-cassiterite deposits, but both quartz-cassiterite and quartz-sulfide deposits also occur alone. Plastic, white to yellow-brown to red earthy mixtures of clays and other minerals usually occur with both the cassiterite and the sulfide deposits. However, cassiterite and sulfide deposits are found where the earthy deposits are absent, and earthy clays are found that contain neither sulfides nor cassiterite. The segregation and identification of these clayey minerals requires specialized techniques beyond the scope of this project.

Massive quartz veins and extensive systems of smaller quartz veins and veinlets pervade the Potato Mountain area. Except in the relatively restricted tin-bearing zones, these quartz veins and veinlets usually contain only traces to minor amounts of pyrite or iron oxides. The most common type of tin deposit is a cluster of cassiterite-bearing quartz veinlets in tourmalinized metasediments adjacent to a fault, joint, or similar opening filled with crushed shale or earthy clay. Many of the smaller clay-filled openings contain quartz and cassiterite, but none of the larger faults were found to contain more than traces of tin.

Permafrost

The bedrock and the detrital cover, throughout the Potato Mountain area, remain permanently frozen; only the top few feet thaw during the summer. Zones that remain thawed throughout the year occur within permafrost areas, but no such zones were recognized at Potato Mountain. No apparatus was available for measuring temperatures in the permafrost or for determining the depths to which the permafrost may extend. Brine solutions were left overnight in drill holes to prevent freezing. Temperatures of the solutions, after flushing out of the hole, were 28° to 30° F. Since warming and mixing took place while flushing the holes, ground temperatures probably were about 20° to 25° F.

The ground temperature at 30 to 50 feet below the surface remains almost constant throughout the year and usually is about equal to the average annual surface temperature. The average annual surface temperature probably is about equal to the average annual temperature at Wales (22° F). The geothermal gradient varies substantially, but averages about 1° F rise in temperature per 70 feet in depth. Therefore, freezing temperatures may extend about 700 feet below the surface. This estimate of the depth of permafrost could not be verified.

Detrital Cover

The principal agent of erosion is frost breaking which can take place only where thawing and freezing occur. The depth of summer thaw varies greatly. The thaw penetrates to great depths where surface water percolates through porous strata on hillsides; on relatively flat, well-drained but impervious surfaces, the thaw may penetrate only 2 feet or less. A cover of vegetation insulates the surface from the sun's heat and tends to inhibit thawing.

Rock debris covers the entire surface, except for an occasional protruding outcrop of resistant rock or a streambank bared by water action. The nature of the detrital material depends on the available openings in the source rocks. Water enters the openings, freezes, expands, and breaks the rock; the resultant rock debris may vary from coarse blocky fragments several feet in diameter to individual crystals or fragments of crystals of the component rock minerals. The debris derived from shales and schists generally forms a soil that supports a vigorous growth of tundra plants and mosses. Calcareous rock debris tends to inhibit the growth of tundra plants which apparently thrive best in an acidic environment. Most igneous rocks and many sedimentary or metasedimentary rocks break into coarse angular blocks and fragments that can support little plant life. Where vegetation is abundant a layer of peat, ranging in thickness from a few inches to a few feet, forms on the surface.

The surface evidences of a rock outcropping depend on the nature of the rock. The outcrop of a hard dense rock that resists frost breaking may protrude through the overlying mantle or may be marked by an abundance of large angular fragments on the surface overlying the outcrop. Rocks of medium resistance to frost breaking ordinarily have no protruding outcroppings, but the outcroppings may be indicated by fragments in the overburden. Relatively soft rocks normally have no visible surface expression; the outcrop is eroded slightly below the outcropping of the more resistant rocks. The material derived from the softer outcrop usually breaks down into small fragments that mix with fragments of more resistant rocks to form an indistinguishable cover. Tin and other hydrothermal minerals commonly occur in deposits that are less resistant to erosion than surrounding rocks; therefore, it is unusual for such deposits to have any visible surface expression.

The frost-broken material is carried downhill as an earth flow that follows regular paths, or float lines, perpendicular to the elevation contour lines. Practically all movement of material takes place in a near-surface "zone of movement" (fig. 5). This zone develops because the ground thaws downward from the surface nearly to an equilibrium point early in the summer. A narrow transitional zone, that thaws gradually as the summer advances, underlies the zone of movement. The transitional zone merges into an underlying

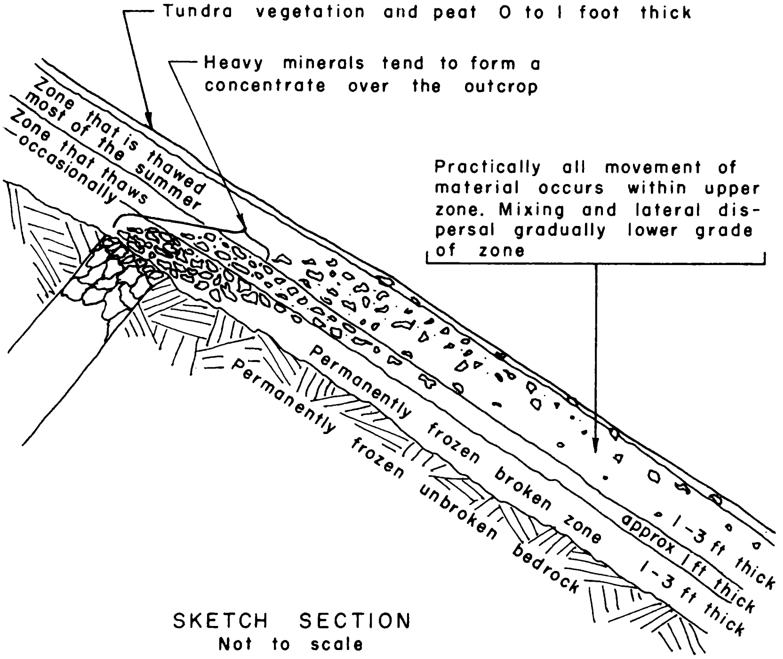

FIGURE 5. - Frost Breaking and Transport of Material From a Typical Outcrop, Potato Mountain Area.

zone of broken but normally frozen material that remains essentially in place except for some downhill creep resembling glacial flow. This broken zone in turn merges gradually into unbroken permanently frozen bedrock.

The heavier fragments broken from an outcrop tend to sink into the transitional and broken zones on top of the outcrop thus forming a residual concentration. The lighter material is carried off in the zone of movement. Ultimately, however, much of the heavy material also is removed. In the zone of movement, heavy minerals are carried along with the lighter frost-broken material; there appears to be a churning or mixing action that prevents heavy material from sinking but results in some lateral dispersal. The mass ultimately enters the streams. Water carries off the finer particles and lighter materials, and a placer concentration develops.

Placer Gravels

A long period of uplift and erosion followed the tin mineralizing epoch. Possibly one or more advance and retreat of the sea dispersed placer accumulations. A relatively recent elevated beach deposit (34), that may be contemporary with the intermediate beach at Nome (letter from Dave Hopkins, Federal Geological Survey geologist), has been identified 12 miles west of Potato Mountain on Boulder Creek in the Cape Mountain area at an altitude of about 90 feet. No similar beach has been found in the Potato Mountain area, but valuable tin placer concentrations are not known below 150 to 175 feet altitude. During the Illinois glacial stage extensive glaciers evidently formed in the mountains 10 to 15 miles south of Potato Mountain (35). Contemporary glaciers may have formed on Potato Mountain but, if so, subsequent erosion has obscured the usual evidences.

The tin-bearing alluvial concentrations in the Potato Mountain area appear to be typical stream placer deposits that formed under present-day conditions. Any deposits that have formed during previous erosive cycles probably have been eroded and redeposited in the streams. The placer gravels are shallower and less extensive than the broad open nature of the valleys and the gentle gradients of the streams would suggest. Evidently erosion and stream transport are about in equilibrium and have been so for a long time. Buck Creek was mined from the mouth about 10,000 feet upstream to the lower part of West Fork. The average gradient was 2 to 3 percent and the gravels averaged about 200 feet wide and 4 to 6 feet deep. Other streams in the area are proportionately similar.

WORK BY THE BUREAU OF MINES

Nature and Extent

The Potato Mountain lode tin outcroppings are buried under frost-broken detritus and a mat of tundra and alpine-type vegetation. Therefore, the area had to be investigated in three stages: First the placer gravels, then the detrital cover, and finally the lode outcroppings. Each stage was designed to eliminate large areas from further consideration, to indicate the general extent of marginal areas, and to delimit the areas to be investigated during the succeeding stage.

The various sampling procedures are described as they pertain to the succeeding steps in the investigation. Many of the placer samples and practically all detrital cover samples were roughly evaluated in the field. All churn-drill placer samples and all lode samples having quantitative value were analyzed in the Bureau of Mines laboratory at Juneau, Alaska. Numerous typical specimens and samples were checked for beryllium, radioactive minerals, and fluorescent minerals. Selected specimens and samples were analyzed spectrographically and petrographically.

Descriptions of the principal placer and lode tin deposits are grouped according to the drainage basin in which the deposits occur. These descriptions are followed by descriptions of miscellaneous prospects. Tin analyses data are included with the descriptions of the deposits. Petrographic descriptions, spectrographic analyses, and analyses for metals other than tin are in special sections following the descriptions of the deposits.

The descriptions of the lode and placer deposits and prospects include maps. An index map of Potato Mountain (fig. 6) shows the location and orientation of the various maps. Sketches, cross sections, and a photograph supplement the descriptions and maps.

Definition of Terms

Geological and related terms in general have been used in accordance with definitions in the 1960 edition of the Glossary of Geology and Related Sciences[3] or in Webster's Third New International Dictionary. The following terms are defined for the reader's convenience:

Clay. - An earthy and usually plastic mixture of fine-grained mineral and rock fragments and crystals found in or along fractures, joints, bedding

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[3] Howel, J. V. (Coordinating Chairman). Glossary of Geology and Related Sciences. American Geological Institute, Washington, D.C., 1960, 397 pp.

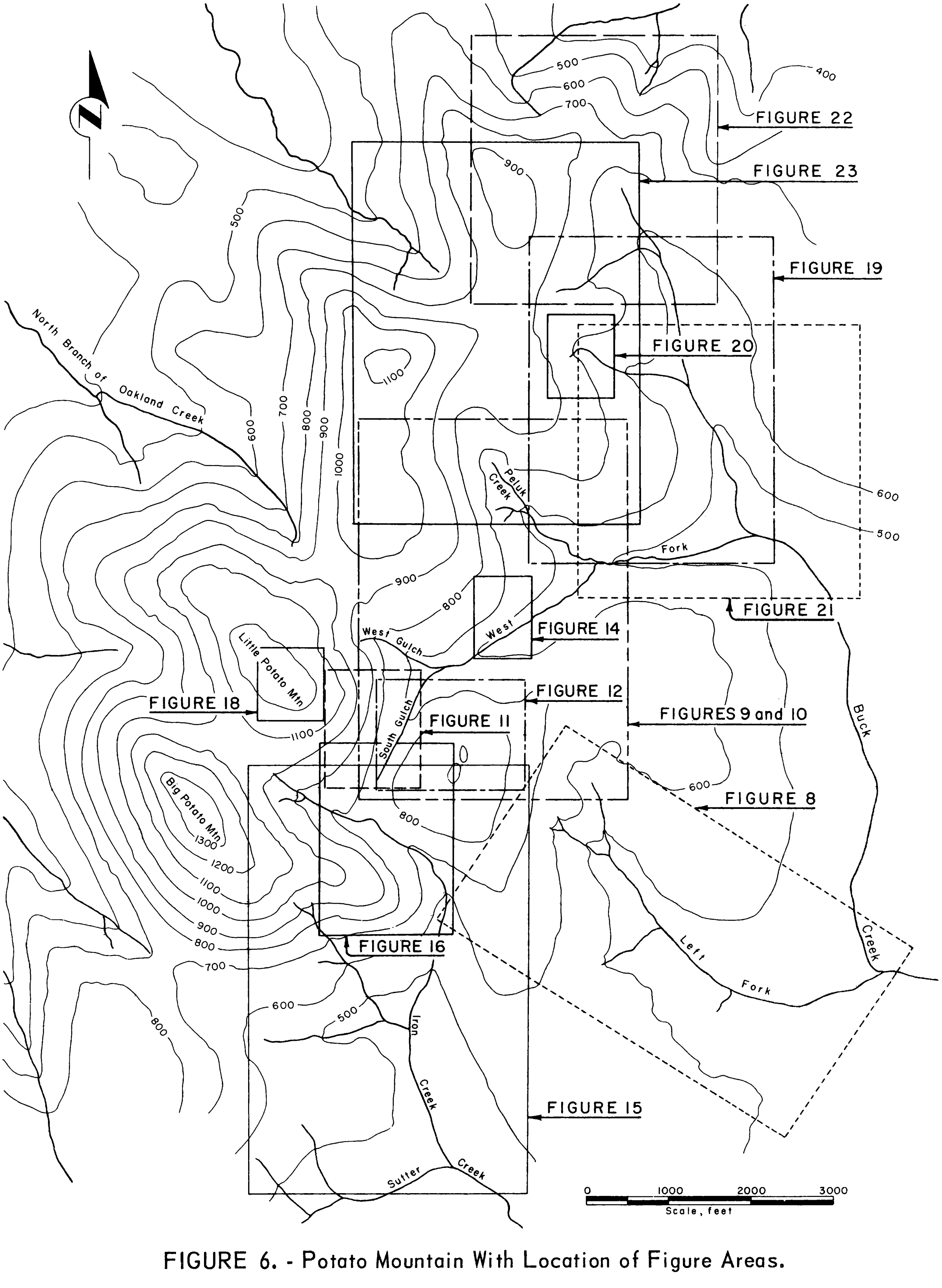

FIGURE 6. - Potato Mountain With Location of Figure Areas.

planes, etc. Both clay minerals and various other minerals may be present in such mixtures.

Daisy Fault, Adit Fault. - Two prominent parallel crush zones, presumably faults, that cut across Iron Creek valley and Little Potato Mountain. The Daisy Fault crosses the summit of Little Potato Mountain a few feet east of the Daisy prospect shaft. The Adit Fault cuts across the eastern slopes of Little Potato Mountain a few feet east of an old adit.

Detrital Cover Sampling. - A term used to indicate that the material sampled is the rock debris that results from frost breaking and other erosive processes. The term is used in preference to the term "soil sampling" for two reasons: First, in the usual sense of the word, soils were scarce or absent; second, the samples were evaluated by placer sampling techniques rather than by the usual soil sediment evaluation procedures.

Float Line. - A generally linear grouping of detached rock fragments extending from the outcrop source downhill to the stream placer deposits.

Left Limit (LL). - The left hand side of a stream gravel deposit when the observer faces downstream.

Right Limit (RL). - The right hand side. Placer miners also commonly refer to the left or right limit bank, tributary, etc., to indicate that the observer faces downstream.

South Gulch, West Gulch. - Two small headwater tributaries of West Fork. The usage is for convenience in this report, but the names have not been passed on by the Board on Geographic Names.

Upper Buck Creek. - As used in this report, the section of Buck Creek that is above the mouth of West Fork. The branch that extends towards the Red Fox prospect is considered to be the main stream.

West Gulch. - See South Gulch.

Placer Sampling and Evaluation

The first stage of the investigation was to collect published data on the placer tin deposits in the Potato Mountain area, principally churn-drill sampling results (30). Gaps were filled by churn-drill sampling, test pitting, or other appropriate means. The objective was to determine the areas from which the placer deposits could have been derived. Therefore, a departure was made from conventional placer evaluation procedures. The pertinent information required was the relative amount of tin that had been deposited and the degree of wear evident on the cassiterite crystals. The value of a placer sample normally is expressed as a given number of pounds per cubic yard contained in a pay horizon of a given depth. For this project, the depth of the pay horizon in feet was multiplied by the pounds of tin per cubic yard and the result was multiplied by 100 (to eliminate decimals). This gave a readily comparable figure (abundance factor) proportional to the amount of tin present regardless of the depth of gravel in which it occurred. When the abundance factors were plotted on a map, areas of comparable abundance could be outlined in a manner similar to drawing contour lines. The minimum grade of the placer deposits mined on Buck Creek is believed to have been at least one pound of tin per cubic yard in a pay horizon averaging about 5 feet deep. Areas of comparable abundance were outlined in the headwater tributaries. The location of these placer concentrations, combined with information on the degree of wear evident on the cassiterite crystals, indicated limited areas from which the placer deposits must have been derived.

Churn Drilling

A churn drill was used to sample the extreme headwaters of West Fork and Iron Creek. No published data were available, and the depth of the placer deposits on these streams made test pitting impractical. Standard placer evaluation procedures were followed, except that reliable water measurements of uncased holes could not be made in the loose unsorted detrital material found near the headwaters of these streams. No clear distinction could be made between overburden and gravel; therefore, the pay horizon was assumed to extend from the surface to bedrock and to include from ½ to 1 foot of bedrock.

The drilling was done with a Fairbanks-type skid-mounted churn drill equipped with bits designed for use inside 5-inch casing. Holes were drilled open where possible, but casing had to be used in many holes. The casing shoe had a diameter of 6½ inches. Theoretical volumes were used in evaluating the sampling results; 0.00568 cubic yard per foot of depth uncased, and 0.00854 cubic yard per foot of depth cased. The depth of the pay horizon in feet (ph) multiplied by the theoretical volume in cubic yards per foot (v) gave the volume of the pay horizon in cubic yards (V). Dividing this volume into the weight of concentrate in pounds (C) gave the pounds of concentrate per cubic yard (c) in the pay horizon. This figure multiplied by the percent of tin in the concentrate (t) gave the value of the pay horizon in pounds of tin per cubic yard (T). For this project an abundance factor (AF) was determined by multiplying the value of the pay horizon by the depth and multiplying this by 100 to eliminate decimals. Computations are summarized as follows:

$$\text{ph} \times \text{v} = \text{V}$$

$$\frac{\text{C}}{\text{V}} = \text{c}$$

$$\text{c} \times \text{t} = \text{T}$$

$$\text{T} \times \text{ph} \times 100 = \text{AF}$$

Test Pitting

Test pits were sunk in the placer gravels either to determine the amount of wear evident on the cassiterite or to determine the upstream limits of deposition; both supplemented churn-drilling and other placer evaluation data as a guide for lode exploration. The test pits were dug in or near the stream channels, usually with a bulldozer but occasionally by hand. The pits were in thawed gravels, and usually filled with water. Consequently, the evaluation of samples from these pits was limited to noting the degree of roundness of the cassiterite crystals, and to determining whether tin was absent, scarce, or abundant. This was adequate for the purpose, and no attempt was made to make more exact determinations of grade.

Detrital Cover Sampling and Evaluation Methods

The second stage of the investigation was to sample the detrital cover. The general plan was to sample along the stream banks in areas from which the placer deposits could have been derived. Sample pits were sunk to permafrost on the sides of the valleys, 5 to 30 or more feet above the valley floor (high enough on the hillside to make it reasonably certain that any material found had been derived from the hill above rather than transported by stream action). The line of sample pits roughly paralleled the stream at intervals of from 30 to 50 feet; most commonly, three samples were taken per 100 linear feet.

Augering and Panning

Sample pits in the detrital material were dug by hand, by bulldozer, and by gasoline-powered posthole auger. Under most conditions, the power-driven auger was the most economical and satisfactory sampling tool because it produced an adequate and reasonably uniform sample within a minute or two after the hole was started (fig. 7). The usual practice was to drill down to permafrost, usually 2 to 3 feet, with a 6-inch posthole auger, stop the machine, and pull up the auger. About one gold pan of material could be obtained from the scroll; this was the sample. On steep rocky hillsides or where boulders were abundant, samples could be obtained more rapidly from hand-dug pits. Bulldozer trenching was slower than the other methods (in samples evaluated per man-day).

Two men, using a tractor and sled to haul panning water and using the gasoline-powered auger to obtain samples, could drill, sample, concentrate, and evaluate 30 to 40 holes per 8-hour day. Cleaning and concentrating a sample usually required more time than obtaining the sample. The panning was done with standard gold pans; the panning water was in two No. 3 washtubs. The sample was washed and screened in a pan in which a close pattern of 3/8-inch round holes had been drilled. The washed oversize was inspected for "nuggets" and discarded. Clay, soil, ice, and vegetable matter were washed from the undersize and decanted off; then the heavy minerals were concentrated by the usual panning techniques. Because of the relatively small size of the individual samples and the great variation in the size range and condition of the sampled material, mechanical concentration was considered impractical with any presently available equipment.

The panned samples were graded visually. The results were recorded as: 0--no tin; 1 (or x)--trace of tin-bearing concentrate; 2 (or xx)--more than a trace but less than an ounce of tin concentrate; 3 (or xxx)--an ounce or more of tin concentrate. A more exact evaluation would have required additional time and equipment and was considered unnecessary. Sample sites were marked to indicate the amount of tin found. Occasionally the identification of

FIGURE 7. - Sampling Detrital Cover With a Gasoline-Powered Posthole Auger. The hole has been drilled, the auger is standing in a gold pan, and the kneeling man is scraping the sample from the scroll into the pan.

cassiterite was verified by placing crystals in hydrochloric acid in the presence of zinc--a tin plate formed on the cassiterite crystals.

Sampling was continued on both sides of a valley to the headwaters; or as far upstream as the stream placers contained tin. The sampling results indicated where the cassiterite-bearing float lines were entering the placers. Normally, an area of interest along a streambank would be indicated by tin minerals in practically every sample for at least several hundred feet. Nothing more was done in areas that contained no tin or only an occasional trace.

The sampling process was repeated a couple of hundred feet up the slope from any areas of interest encountered. The second row of holes roughly paralleled the first and was continued until no cassiterite was found at either end. Additional similar lines of holes were put in at successively higher elevations until no more tin minerals were found or the summit was reached. This procedure outlined an area in which the detrital material contained tin. The uppermost lode source usually would be obvious, but minerals derived from the uppermost deposits tended to obscure lode outcroppings lower on the hillside. Therefore, additional samples were taken to form a rough grid pattern. Zones of higher-than-normal concentrations within this grid usually occurred in a pattern that indicated the general location of outcrops.

Amount of Tin Detectable

Twenty samples of the detrital cover were analyzed to determine the minimum amount of tin that a skilled panner could detect in the field by routine panning and visual inspection. Samples were taken at sites where panning indicated either traces of cassiterite or no cassiterite. As a matter of interest, one sample was taken where panning indicated an abundance of tin.

Two samples were taken at each sample site; each sample filled one 16-inch gold pan. Both samples were washed and screened with a pan in which a pattern of 3/8-inch round holes had been drilled. Oversize was discarded and slimes were decanted off. One sample was panned on the spot, and the tin content was estimated. The duplicate sample was analyzed in the laboratory at Juneau. Results of the test are in table 5.

The tests showed that 0.05 percent tin can be detected in the field by routine panning if the tin occurs as visible cassiterite crystals. Cassiterite crystals that occur attached to lighter minerals might be lost during the panning process. For this reason, tourmaline schists with disseminated fine-grained cassiterite may be more widespread than indicated by the sampling. Minor amounts of tin occurring as a component of stannite or some other tin mineral probably would not be recognized in the field; therefore, selected panned samples from the various areas sampled were submitted for petrographic analyses.

TABLE 5. - Amount of cassiterite in detrital material detected by panning

Sample	Panner's estimate[1]	Sample, percent tin[2]	Sample	Panner's estimate[1]	Sample, percent tin[2]
1...........	X	0.05	11...........	X	0.05
2...........	X	.05	12...........	0	None
3...........	0	Trace	13...........	0	Trace
4...........	0	Trace	14...........	0	Trace
5...........	0	Trace	15...........	0	Trace
6...........	0	Trace	16...........	0	None
7...........	0	Trace	17...........	0	Trace
8...........	0	Trace	18...........	0	Trace
9...........	X	.05	19...........	XXX	.60
10...........	X	.05	20...........	X	.05

[1] X Trace of cassiterite. XXX Abundant cassiterite.

[2] Chemical analyses.

Lode Sampling and Evaluation Methods

Bulldozer Trenching

The final stage of the investigation was to expose and sample the lode outcroppings. Trenches were started where detrital cover sampling indicated the presence of outcroppings. When exposed by bulldozer trenching, the frozen detrital material would thaw from an inch to a foot or more per day. A sample of the newly exposed material in the trench bottom was panned. If no tin was found, the trench or section of trench was abandoned. If tin was found, the thawed material was removed and the process repeated until tin minerals were traced downward to the lode outcropping.

Heavy minerals tend to form a residual concentrate on and near the frost-broken outcroppings. In every case that could be checked, the material on or directly over the outcrop was higher in grade than the lode source. The ratio of concentration varied widely; the broken material overlying the outcrop might contain up to 10 times as much tin as the lode. The weathered material exposed in the bottom of a bulldozer cut could not always be distinguished from bedrock, particularly where clay alteration was extensive. Therefore, the maximum depth to which surface concentration might extend never was determined satisfactorily. Samples taken 1 or 2 feet below the apparent bedrock surface often contained several times as much tin as those taken 3 to 6 feet deeper.

The outcrop was cleaned and sampled after it had thawed. In some cases, trenches 1 to 3 feet deep were excavated by pick and shovel in the bottom of the bulldozer trenches prior to sampling. Uniform channels were cut in the clay-quartz and soft shaly deposits with a prospector's pick and an iron spoon. Zones containing harder rocks required the use of a hammer and moil. Chip samples were taken across some of the obviously lower grade deposits. Many outcroppings had to be resampled when it became evident that residual concentration extended into the apparent bedrock. Because of the inherent difficulties of digging frozen bedrock of varying hardnesses, it is not certain that all samples were taken below the zone of residual concentration.

Diamond Drilling

Five diamond-drill holes, ranging in depth from 114 to 213 feet for a total of 764 feet, were drilled with a conventional gasoline-powered drill. Normal core drilling procedures were followed. Drilling water was pumped from the extreme headwaters of West Fork. The broken nature of the rock made core recovery poor; sludge samples were saved at all times. Water and sludge recovery usually were good but the clay-filled openings in the rock may have affected the grade of the sludge samples. The cracks in the rocks could have acted as riffles to hold heavy minerals or the water action could have washed extra material from the cracks into the holes. The diamond drilling data can be considered only as generally indicative of the grade of material encountered.

Permafrost was encountered in all holes at all depths. This presented no particular difficulty except that water in the drill hole would freeze if the drilling water was too cold, or if circulation stopped. When the temperature of the water entering the drill pump dropped below 37° F, drilling was stopped because, at lower temperatures, ice formed in the return water and there was danger of a "flash freeze." As a matter of routine, whenever circulation was stopped for more than 30 minutes, about 10 or 15 pounds of calcium chloride or rock salt were poured down the hole. This eliminated loss of time drilling out ice, but care was required when flushing out the brine solution. After standing overnight, the temperature of the brine solution in the hole was estimated to be about 20° to 25° F. Fresh water would freeze in the rods as they were lowered into the brine unless circulation was maintained.

Cement was used instead of casing, whenever practical, because the broken, highly abrasive, quartz- and tourmaline-bearing metasediments caused excessive wear on casing and casing bits. Portland cement and "quick-setting mixes"[4] were tried. Portland cement would not set in the drill hole even if left for 2 days; apparently the permafrost inhibited the setting action. The usual "quick setting mixes" of portland and lumnite cement behaved freakishly; they set while being mixed and poured or never set at all. However, it was found that a mixture containing 80 percent lumnite cement and 20 percent portland cement would produce a hard durable concrete if left in the hole overnight.

Summary of Published Data on the Relative Abundance of Tin in the Placer Deposits

The relative abundance of cassiterite in the placer gravels of the streams draining Potato Mountain was estimated from published data (table 6 and fig. 3). These rough estimates are in no way indicative of the recoverable tin because mined-out tin has been included and sample spacing has been disregarded. The estimates, however, do indicate where the principal placer tin concentrations formed, and thus indicate where the principal sources must have been.

Buck Creek and some of its tributaries contained many times more placer tin than any of the other streams in the Potato Mountain area. The configuration of the Buck Creek placers and the distribution of tin in its various tributaries indicated that the principal lode sources of the placer tin were in the Buck Creek drainage basin and probably in the area drained by Upper Buck Creek, West Fork, Iron Creek, and Left Fork on the eastern slopes of Potato Mountain (fig. 3). Although erosional conditions were similar, only relatively small amounts of placer tin were found in the other drainage basins in the Potato Mountain area. This indicates relatively minor lode sources. Therefore, except for brief examinations, the investigations were confined to the Buck Creek drainage basin.

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[4] The most common "quick-setting mixes" used in diamond drilling are mixtures of portland and lumnite cement that take an initial set in 10 to 30 minutes and a final set in 1 hour or less. Normally the proportions, by weight, range from 15 to 25 percent lumnite cement, with the balance portland cement. The exact mix to be used must be determined by experiment; variations in the temperature, the water, or even the batch of cement used will cause variations in setting time.

TABLE 6. - Summary of published data on tin placer deposits, Potato Mountain area[1]

Creek	Tin, lb per cu yd[2]	Churn drill holes averaged	Location of deposit	Remarks
Peluk Creek.....	0.5	2	Near mouth.	No mining.
Upper Buck Creek	1.0	17	Below mouth of first right limit tributary above West Fork.	About 0.2 lb tin per cubic yard found above the first right limit tributary.
West Fork.......	1.1	18	From mouth to headwaters.	Mined for about 1,000 feet[3] above the mouth.
Buck Creek......	2.9	-	Mined from West Fork 15,000 feet downstream to Grouse Creek.	Estimate based on mining records.
Grouse Creek....	2.9	-	From the mouth of Buck Creek downstream about 5,000 feet to the mouth of East Fork.	Reports (23) indicate that the tin occurred as much rounded cassiterite and that no tin was found above the mouth of Buck Creek.
Iron Creek......	.6	11	Downstream from base of Big Potato Mountain.	Hand mined about 1,500 feet along stream bed prior to drilling.
Sutter Creek....	.2	30	Downstream from mouth of Iron Creek.	Mined from mouth upstream about 1,000 feet.[3]
Left Fork.......	Unknown	None	Unknown.	Mined from the mouth upstream about 2,500 feet.[3] Only traces of tin reported above the workings.
Potato Creek....	.2	15	Downstream from a small left limit tributary that enters Potato Creek about 2 miles west-northwest of Big Potato Mountain.	No mining.
Oakland Creek...	.1	15	Extends about 1 mile along creek channel near western base of Potato Mountain.	This stream also called Diomede Creek and Lynx Creek.
Red Fox Creek...	Unknown	None	None known.	Occasional traces to minor amounts of tin can be panned. No mining.

[1] Includes mined-out tin and is not indicative of recoverable tin. Data from Bureau of Mines Report of Investigations 4418 (30) unless otherwise stated.

[2] Average grade of samples from the pay streak.

[3] Data from conversation with George Ramstad who mined this stream after publication of Report of Investigations 4418 (30).

Old Placer Mining Pits

A single continuous placer mining pit extends from near the mouth of East Fork on Grouse Creek upstream to the mouth of Buck Creek, then up Buck Creek to the mouth of West Fork, and up West Fork about 1,000 feet (figs. 3 and 4). Branches of this pit extend over 1,000 feet up Sutter Creek and about 2,500 feet up Left Fork. The only other recognizable placer working in the Potato Mountain area is a narrow, hand-dug placer pit that extends about 1,500 feet down Iron Creek from the base of Big Potato Mountain.

Buck Creek

Buck Creek was examined to determine if the placer tin was derived from the headwaters or from many places along the banks. Starting at Grouse Creek (figs. 3 and 4) and continuing upstream, samples from pits in the placer gravels of Buck Creek were panned and examined. It was found that the tin occurred as cassiterite crystals that showed progressively less wear as the headwater tributaries were approached. Concurrently, samples were panned from shallow pits sunk on the banks where quartz float appeared and in tributary gullies and streams. No tin was found on the banks of Buck Creek or in the gullies entering Buck Creek, but traces of tin were found in several of the tributary streams. The only tributaries that contained more than traces of tin were Sutter Creek, Left Fork, West Fork, and Upper Buck Creek (above West Fork).

Typical specimens of vein and dike material, that might have been the source of placer deposits, were collected (table 7). Tin was found to occur as cassiterite in fragments of vein quartz; however, most quartz fragments contained no cassiterite. Tourmaline, pyrite, and arsenopyrite were associated with the cassiterite in some specimens. A few specimens of quartz-porphyry dike were found but little or no tin occurred in this material. The relative scarcity of quartz-porphyry fragments and the general scarcity of tin in the fragments suggested that little cassiterite was derived from this source.

TABLE 7. - Description of typical specimens of vein and dike rocks found in the Buck Creek placers

Specimen	Petrographic description	Tin, percent[1]
5-1-1...	The specimen is a segment of a vein 3 to 6 cm in width, composed predominantly of cassiterite, abundant quartz, and minor limonite and tourmaline. The vein is bordered by tourmaline schist on both walls. An irregular subdued foliation in the cassiterite vein perpendicular to the tourmaline schist walls is indicated by limonitic rows of holes, irregular quartz lenses, and irregular cassiterite bands. The limonite-stained holes in the cassiterite vein may be remnants of earlier iron sulfide. Almost pure quartz veins penetrate both the cassiterite vein and the tourmaline schist and have more limonite stain or color than the quartz lenses associated only with the cassiterite vein.	-

See footnote at end of table.

TABLE 7. - Description of typical specimens of vein and dike rocks found in the Buck Creek placers--continued

Specimen	Petrographic description	Tin, percent[1]
5-1-1A..	The specimen is a fragment of a quartz vein which is adjacent to some cassiterite and includes other small cassiterite crystals. Running through the quartz in parallel rows are limonite-stained holes up to 1 mm in diameter. Also present are 2 sets of crosscutting fractures stained with limonite. A few grains of tourmaline are associated with cassiterite aggregates. The parallel rows of limonite-stained holes in this sample are analogous to those in sample 5-1-1. These two fragments probably are of related origin.	-
5-1-2...	The specimen is a "breccia" of angular shale fragments in a matrix of pure white quartz. Parallel rows of quartz prisms are oriented perpendicular to and adjacent to the embedded shale fragments. Cavities within the quartz matrix are also lined with parallel growths of quartz prisms. The average width of these prisms is 0.5 mm.	-
60-32...	The specimen is composed predominantly of cassiterite with abundant biotite-chlorite and lesser amounts of limonite and arsenopyrite.	-
100.....	The specimen is composed predominantly of massive vein quartz with yellow limonite stains. Small amounts of radiating fibrous iron silicate, present in cavities of the vein quartz, are tentatively identified as cummingtonite. A trace of light-green tourmaline is present. Cassiterite occurs as partly euhedral crystals filling a cavity in the vein quartz.	-
101.....	The specimen is composed of quartz and cassiterite intimately mixed in vein quartz. Essentially all the mineral grains of both quartz and cassiterite are coarser than 2 mm in diameter. A few small cavities in the vein quartz are partly filled with light-colored limonite.	-
239.....	The specimen is a highly altered acidic dike composed of a hydrothermal clay, tentatively identified as hydromuscovite (hydromica or illite), and a small amount of clear quartz. Dark, prismatic-shaped areas are filled with tourmaline, probably an alteration product from an earlier ferromagnesian phenocryst.	0.02
240.....	The specimen is composed of cassiterite with quartz, limonite, and tourmaline.	63.1
242.....	The specimen is composed of quartz, very fine-grained vein quartz, and limonite; dark areas contain fine-grained tourmaline. No tin mineral was detected.	.03

See footnote at end of table.

TABLE 7. - Description of typical specimens of vein and dike rocks found in the Buck Creek placers--continued

Specimen	Petrographic description	Tin, percent[1]
243.....	The specimen is a highly altered acidic dike composed of hydrothermal clay, tentatively identified as hydromuscovite (hydromica or illite), and a small amount of clear quartz. Dark, prismatic-shaped areas are filled with tourmaline, probably an alteration product of earlier ferromagnesian minerals.	0.02
245.....	The specimen is composed of quartz with small dark areas of cassiterite and tourmaline.	2.78
246.....	The specimen is composed of quartz with small amounts of pyrite, limonite, and tourmaline. Traces of tin and zinc are present, but no tin or zinc mineral was detected.	.04
247.....	The specimen, locally termed "greenstone," is a quartz basalt containing the calcic feldspar labradorite.	<.01

[1] Determined by chemical analyses. Dash indicates no chemical analysis made.

Left Fork Drainage Basin

Examination of Left Fork (fig. 8) revealed little tin above the mining pits. However, reliable samples could not be taken because of a deep cover of frozen muck. No tin was found in the banks. Test pits were dug in each of the three headwater tributaries of Left Fork. Panned concentrates contained chiefly phyllite fragments, quartz, and limonite pseudomorph after pyrite. In the center headwater tributary a shallow and narrow tin-placer deposit contained somewhat under 1 pound of tin per cubic yard near the mouth and less towards the head. The northern headwater tributary contained little more than traces of tin. The southern headwater tributary contained only the usual trace of tin commonly found in placer gravels throughout the area. Evidently the tin in the Left Fork placers was derived principally from the area drained by the central headwaters tributary. Descriptions of lode deposits in the area drained by this tributary are included with the data on lode deposits in the West Fork drainage basin.

West Fork and Peluk Creek Drainage Basin

Placer Sampling, West Fork

The results of Bureau of Mines 1943 churn drilling on West Fork and Peluk Creek (fig. 9 and table 8) indicated that a pay streak extended nearly to the head of West Fork but that little tin occurred on Peluk Creek except near the mouth. Test pits were dug in all the headwater tributaries of Peluk Creek, including dry gullies. No tin was found. This and the configuration of the West Fork placer deposit suggested that some placer tin may have been derived from the area near the mouth of Peluk Creek but that most of the tin was derived from the headwaters of West Fork.

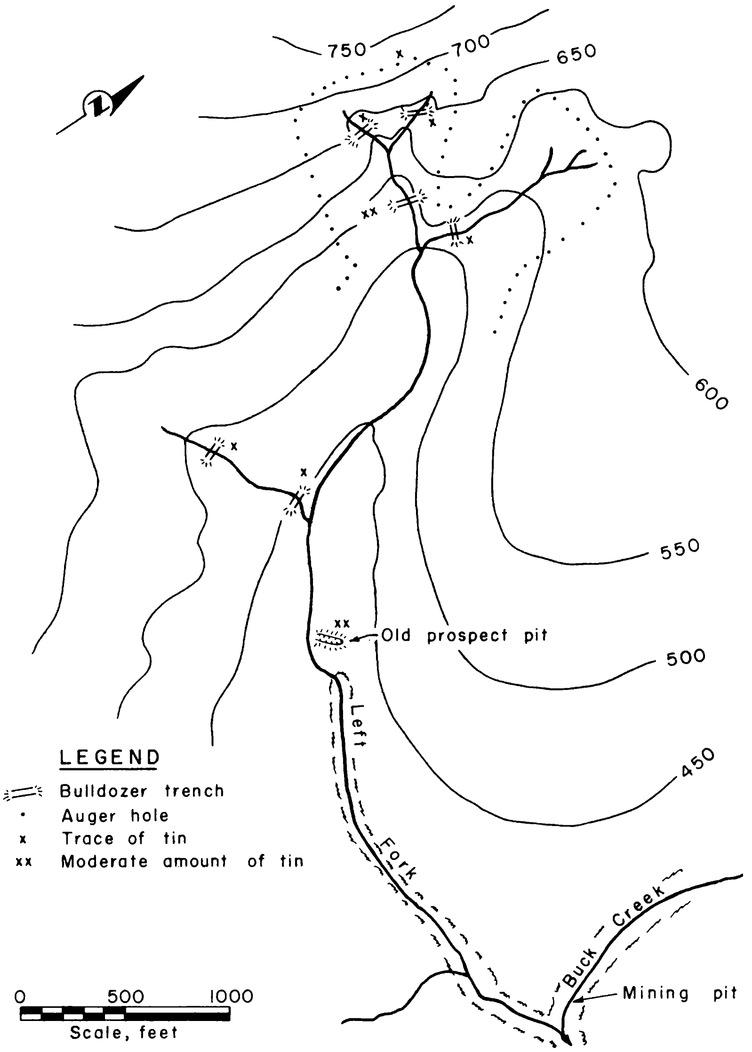


FIGURE 8.-Placer and Detrital Cover Sampling, Left Fork.

Seventeen churn-drill holes were drilled at the head of West Fork to delineate the upstream limits of placer deposition (fig. 9 and table 9). The placer deposits were found to extend into the extreme headwater tributaries. A considerable placer deposit extended to the extreme headwaters of South Gulch, but only a minor amount of tin occurred in West Gulch. This suggested that the tin in the West Fork placers was derived principally from South Gulch.

The cassiterite in the West Fork placers generally was angular indicating that it had not been transported great distances. Placer sampling results indicated that much of the tin was derived from South Gulch but some tin was derived from Peluk Creek and West Gulch. Therefore, it seemed probable that tin also was derived from other places in the valley.

Detrital Cover Sampling, West Fork

The detrital cover was sampled on both banks of West Fork, South Gulch, West Gulch, and the lower third of Peluk Creek (fig. 10). Results indicated that practically all the tin in the West Fork placer gravels was derived from an area drained by South Gulch and extending a few hundred feet down West Fork. A comparatively minor amount of tin was derived from the Peluk Creek-West Fork divide on the south side of Peluk Creek. Further work in the West Fork drainage basin was confined to these areas.

Additional samples were taken in lines generally parallel to the streambanks to outline the tin-bearing areas. The higher-than-normal grade zones within these areas were defined by rough grids of more closely spaced samples. A roughly circular tin-bearing area about 1,500 feet in diameter was outlined in the South Gulch drainage basin. Within this area numerous higher grade zones formed an irregular pattern on both sides of South Gulch. In the Peluk Creek-West Fork area scattered traces of tin formed a poorly defined zone that included one relatively small, well defined zone of higher-than-normal grade.

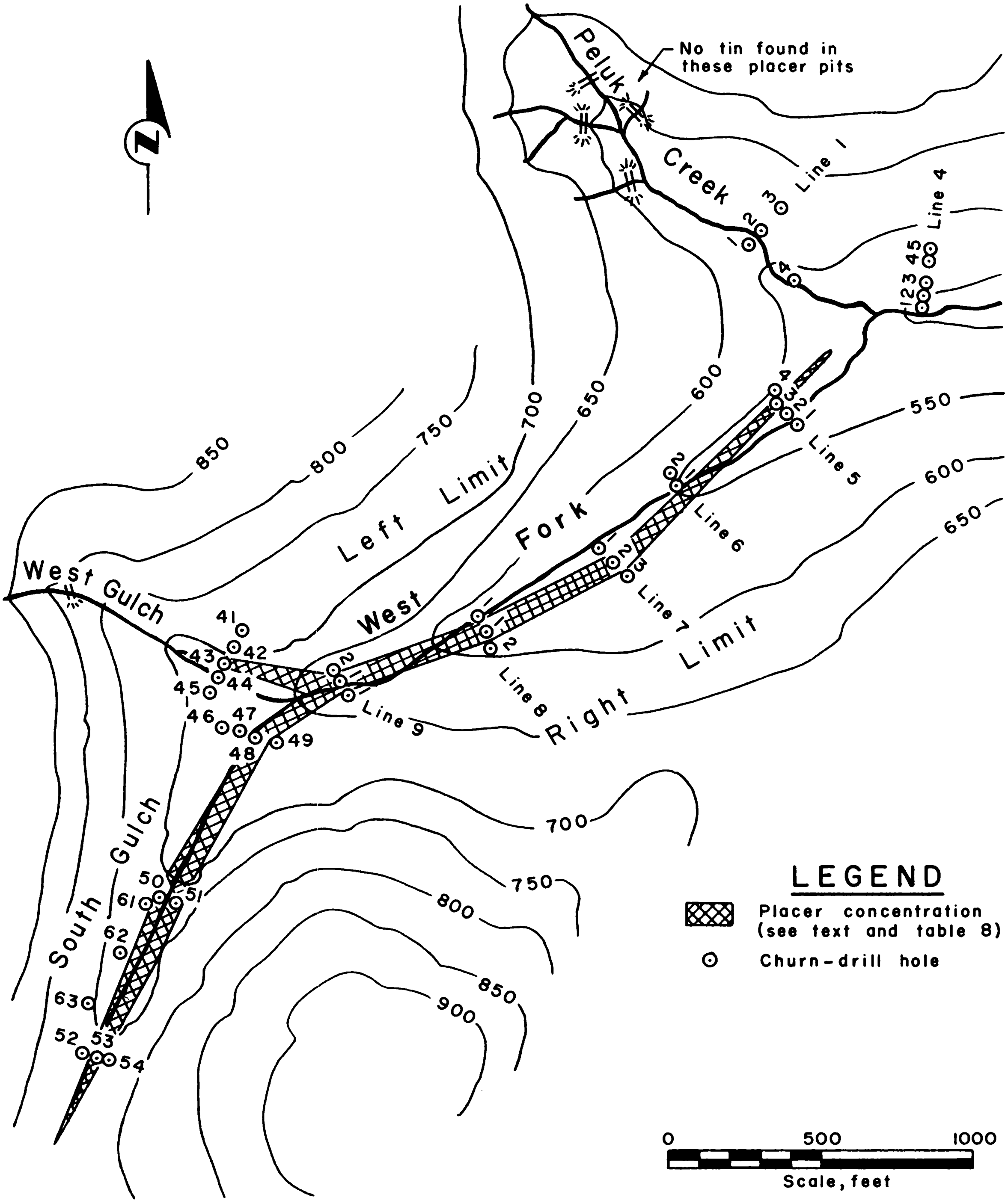


FIGURE 9. - Tin Placer Deposits, West Fork.

TABLE 8. - Churn-drilling results, 1943, West Fork and Peluk Creeks[1]

Creek and Line	Hole	Mining section, feet	Tin, lb per cu yd	Abundance factor[2]
Peluk Creek: 1	4	4.0	0.77	308
	3	3.5	.22	77
	2	5.0	.04	20
	1	2.0	.01	2
West Fork:				
2	2	4.0	.10	40
	1	3.0	.34	102
3	2	4.0	.04	16
	1	3.5	.35	122
4	5	5.0	.75	375
	4	3.0	.97	291
	3	2.0	.49	98
	2	2.0	1.68	336
	1	5.0	.07	35
5	4	3.0	.85	255
	3	2.0	5.98	1,196
	2	4.0	.20	80
	1	.0	.0	0
6	2	2.0	.31	62
	1	4.0	.05	20
7	1	4.0	.59	236
	2	4.0	2.06	824
	3	3.0	.61	183
8	1 (LL)	7.0	.31	217
	1 (RL)	7.0	2.86	2,002
	2	4.5	.31	140
9	2	5.0	.14	70
	1 (LL)	6.0	1.44	864
	1 (RL)	8.0	.07	56

[1] Table based on data abstracted from Bureau of Mines Report of Investigations 4418 (<u>30</u>).

[2] (Mining section, feet) x (tin, lb per cu yd) x 100 = abundance factor. See section of this report entitled "Placer Sampling and Evaluation."

TABLE 9. - Churn-drilling results, West Gulch and South Gulch[1]

Hole	Drill-hole depth, feet					Concentrate		Mining section			
	Total	Overburden	Gravel	Bedrock	Cased	Weight, lb	Tin, percent	Depth, feet	Vol,[2] cu yd	Tin, lb per cu yd	Abundance factor[3]
41	25.5	3.0	17.0	5.5	23.0	2.75	0.75	18	0.154	0.13	234
42	23.5	-	20.5	3.0	21.5	1.67	.25	21	.179	.02	42
43	17.0	-	14.0	3.0	6.6	2.61	.96	15	.070	.36	540
44	15.5	.5	12.0	3.0	5.0	1.40	.20	13	.061	.05	65
45	16.5	-	13.5	3.0	15.0	1.11	1.50	14	.120	.14	196
46	21.5	-	9.0	12.5	5.0	2.82	.21	10	.047	.13	130
47	25.9	-	22.0	3.9	3.0	2.30	.05	23	.108	.01	23
48	26.7	-	22.0	4.7	3.0	2.41	3.16	23	.108	.70	1,610
49	13.0	-	11.0	2.0	11.2	.89	1.22	12	.102	.11	132
50	32.0	4.0	24.0	4.0	4.0	2.21	5.39	25	.117	1.02	2,550
51	18.8	-	16.5	2.3	3.0	1.83	2.46	17	.080	.56	952
52	19.5	-	18.0	1.5	3.0	1.40	.87	19	.089	.14	266
53	31.2	-	29.0	2.2	10.0	3.28	1.76	30	.140	.41	1,230
54	24.8	-	22.0	2.8	4.0	2.43	.66	23	.108	.15	345
61	31.2	-	26.0	5.2	3.0	4.50	.30	27	.126	.11	297
62	28.2	-	20.0	8.2	3.0	3.33	.53	21	.098	.18	378
63	10.0	-	7.5	2.5	3.0	1.07	.23	8	.037	.07	56

[1] Table based on data obtained during this project.

[2] Average volume of drill hole is 0.00854 cubic yard per linear foot of cased drill hole, and 0.00468 cubic yard per linear foot of uncased drill hole.

[3] (Mining section, feet) x (tin, lb per cu yd) x 100 = abundance factor. See section of this report entitled "Placer Sampling and Evaluation."

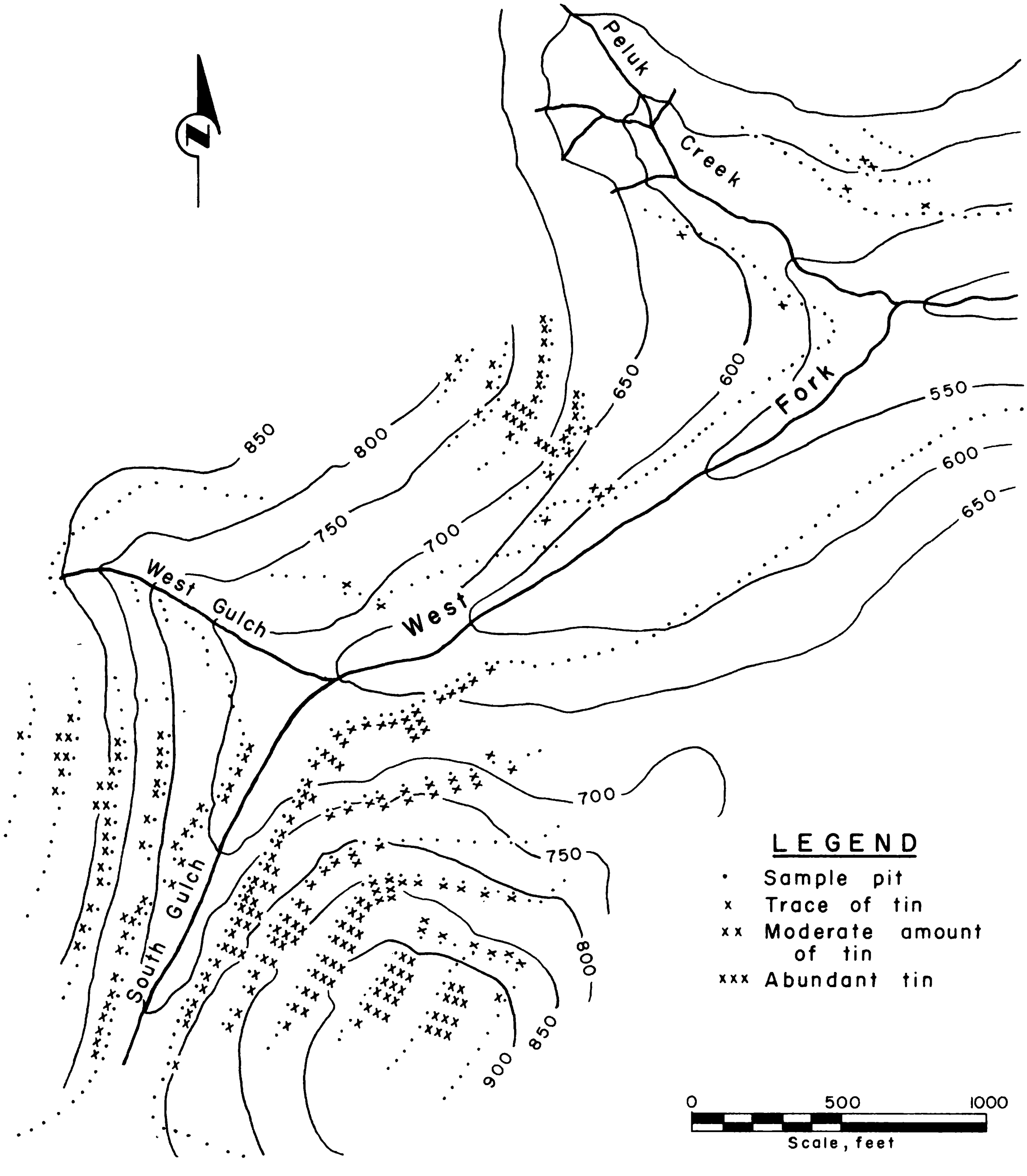


FIGURE 10. - Detrital Cover Sampling, West Fork.

Lode Sampling, West Fork

The lode deposits were exposed by bulldozer trenching. The west side of South Gulch was started first, then the east side, and later the Peluk Creek area. Trenches were excavated where detrital cover sampling indicated higher-than-normal concentrations of cassiterite. The irregular concentrations in the South Gulch drainage basin were difficult to interpret. Therefore, trenches also were put down to intersect apparently favorable structural features, particularly large faults.

Diamond drilling supplemented trenching in the South Gulch area. The drill was used to probe areas too deeply buried to be exposed by trenching and areas where trenching was slow and difficult. In the latter case, the drilling results indicated where trenches were needed. When drilling started, the available evidence suggested that the principal tin deposits were alined with the eastward-dipping bedrock. Several poor exposures also suggested the presence of a mineralized westward-trending fault. Drilling results indicated that the tin occurs in an irregularly disseminated stockwork of discontinuous fracture fillings and bedding plane deposits associated with tin-bearing tourmaline schists. Earthy clays are common. The intense fracturing and the combination of hard tourmaline schists and soft earthy material made core recovery poor and sludge samples doubtful. Drilling was stopped when it became evident that additional holes would add little to the information obtainable on the surface.

A 3-inch hand-held power auger was used to probe the frozen overburden. The auger could penetrate 10 to 20 feet into frozen detrital material derived from the softer schists and shales, but it would not pierce the rubble of broken quartz and tourmalinized schist that usually covered the tin deposits. The auger was used principally when laying out trenches. The information gained usually was negative and of transient value. A few auger holes that penetrated faults or other features have been recorded with trench sampling results.

West Side of South Gulch

Seven trenches were started on the west side of South Gulch. Sample locations are shown on figure 11, and sample descriptions and analyses data are in table 10. Discontinuous extensions added to trenches are indicated by the letter A or B following the trench number. Trenches LL-7 and LL-6 were abandoned because only occasional traces of tin were found. Sections of trenches LL-2 through 5 were continued to bedrock to expose a zone of quartz veinlets about 1,000 feet long and 7 feet in normal width alined with the metasedimentary bedding. Clay minerals with some quartz and cassiterite extend outward from this zone along a fracture intersected by trenches LL-4 (samples 59-123 through 59-127) and LL-2 (samples 61-128 through 61-131). The Adit Fault was intersected by trenches LL-2A, LL-3, LL-4, and LL-5. Only scant traces of tin were found in the crushed filling. This fault extends into the Iron Creek drainage.

East Side of South Gulch

Trenching was started on the east side of South Gulch shortly after starting on the west side. The trench numbers indicate the order in which the trenches were excavated; otherwise, procedures were the same. Trenches and sample locations are in figure 12; sample descriptions and analyses data are in table 11.

The trenching revealed irregularly disseminated quartz-cassiterite veins and veinlets with pyrite, arsenopyrite, and hydrothermal clays associated with hard tin-bearing tourmaline schists. Tin is most abundant in a zone about 300 feet long and 10 to 30 feet wide extending from trench RL-3 to trench RL-5. Within this zone grade ranges from less than 1 to almost 10 percent tin; the

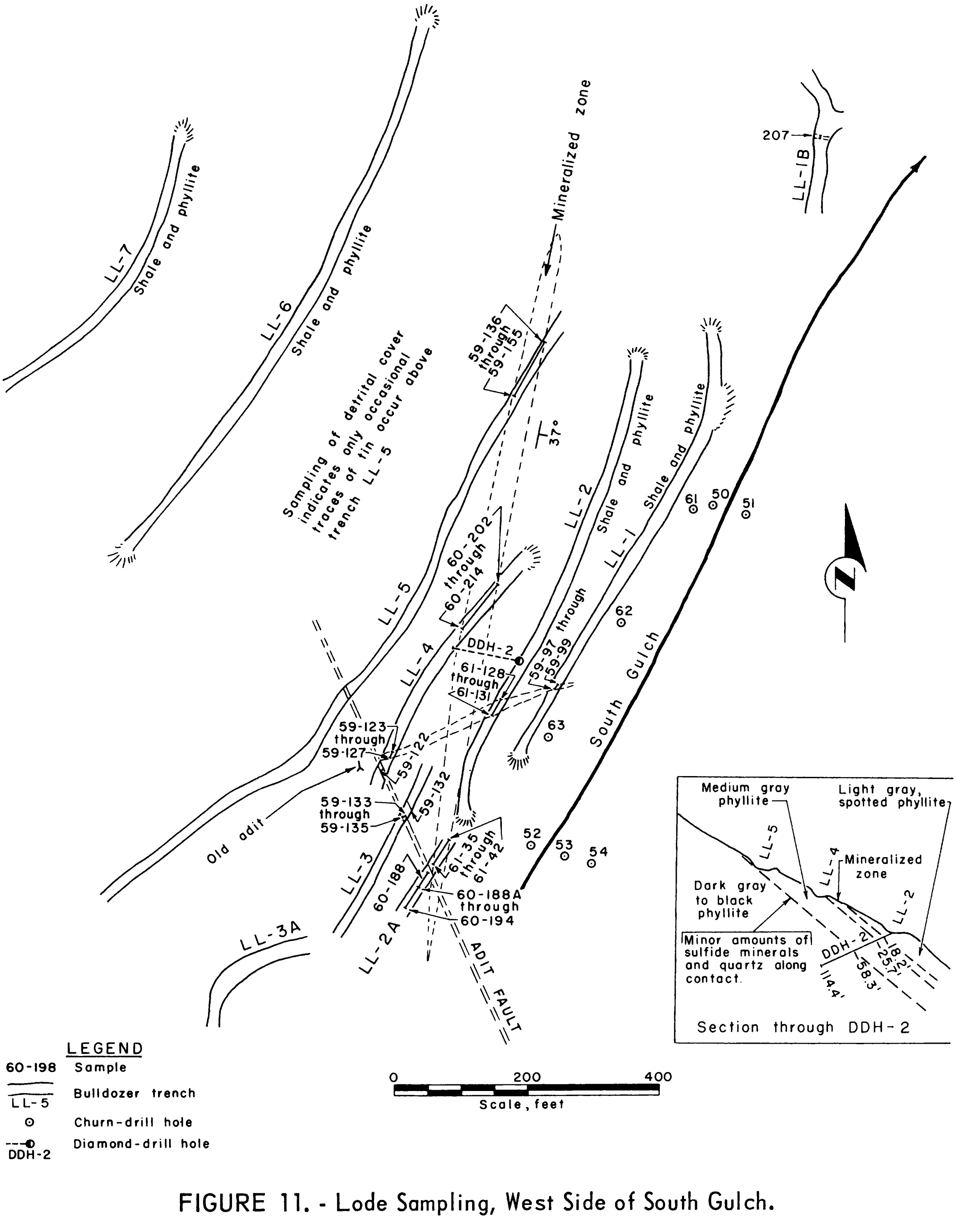


FIGURE 11. - Lode Sampling, West Side of South Gulch.

average may be about 1 percent tin, but the extreme irregularity makes any determination of average grade doubtful. Outside this zone are numerous similar, but smaller and lower grade zones. Trench RL-1 exposed 14 feet of clay and quartz with an average grade of 1.42 percent tin. Attempts to find an extension of this deposit were unsuccessful. Other similar concentrations ranged in grade from 0.75 percent tin downward to less than 0.1 percent tin. No tin was found east of the shaly limestone exposed in trench RL-19 (fig. 13), except for a narrow zone of clay and quartz veinlets alined with the sedimentary bedding and exposed in trench RL-8 and trench RL-6 (sample 59-13).

TABLE 10. - Description and analyses of trench samples, west side of South Gulch

Description			Analyses		
Sample		Character of material	Tin, per-cent	Spec.[1]	Petro.[2]
Number	Length, feet				
		Trench LL-5			
59-136	5	Altered shale, iron-stained clay, and quartz	0.90	-	-
59-137	5	do	.24	X	-
59-138	4	do	1.60	X	-
59-139	1	do	.29	X	-
59-140	5	do	<.01	-	-
59-141	5	do	<.01	-	-
59-142	5	do	.46	-	-
59-143	5	do	.02	-	-
59-144	5	do	.02	-	-
59-146	5	do	.67	-	-
59-147	5	do	.83	-	-
59-148	5	do	<.01	-	-
59-149	5	do	.36	-	-
59-150	5	do	.11	-	-
59-151	5	do	.05	-	-
59-152	5	do	.03	-	-
59-153	5	do	.02	-	-
59-154	5	do	.63	-	-
Total or average	85		.33	-	-
59-155	5	Gray to brown shale	<.01	-	-
		Trench LL-4			
60-202	5	Iron-stained shale with quartz veinlets	0.06	-	-
60-203	10	do	.08	-	-
60-204	5	do	.09	-	-
60-205	3	Altered shale, clay, and quartz	.25	-	-
60-206	3	do	.23	-	-
60-207	3	do	.15	-	-
60-208	4	do	.10	-	-
60-209	5	do	.03	-	-
60-210	5	Clay with some quartz	<.01	-	-
60-211	5	do	.40	-	-
60-212	5	Altered shale, quartz, and some clay	.62	-	-
60-213	5	Altered shale and quartz	.01	-	-
60-214	5	Soft altered shale	.01	-	-
Total or average	63		.15		

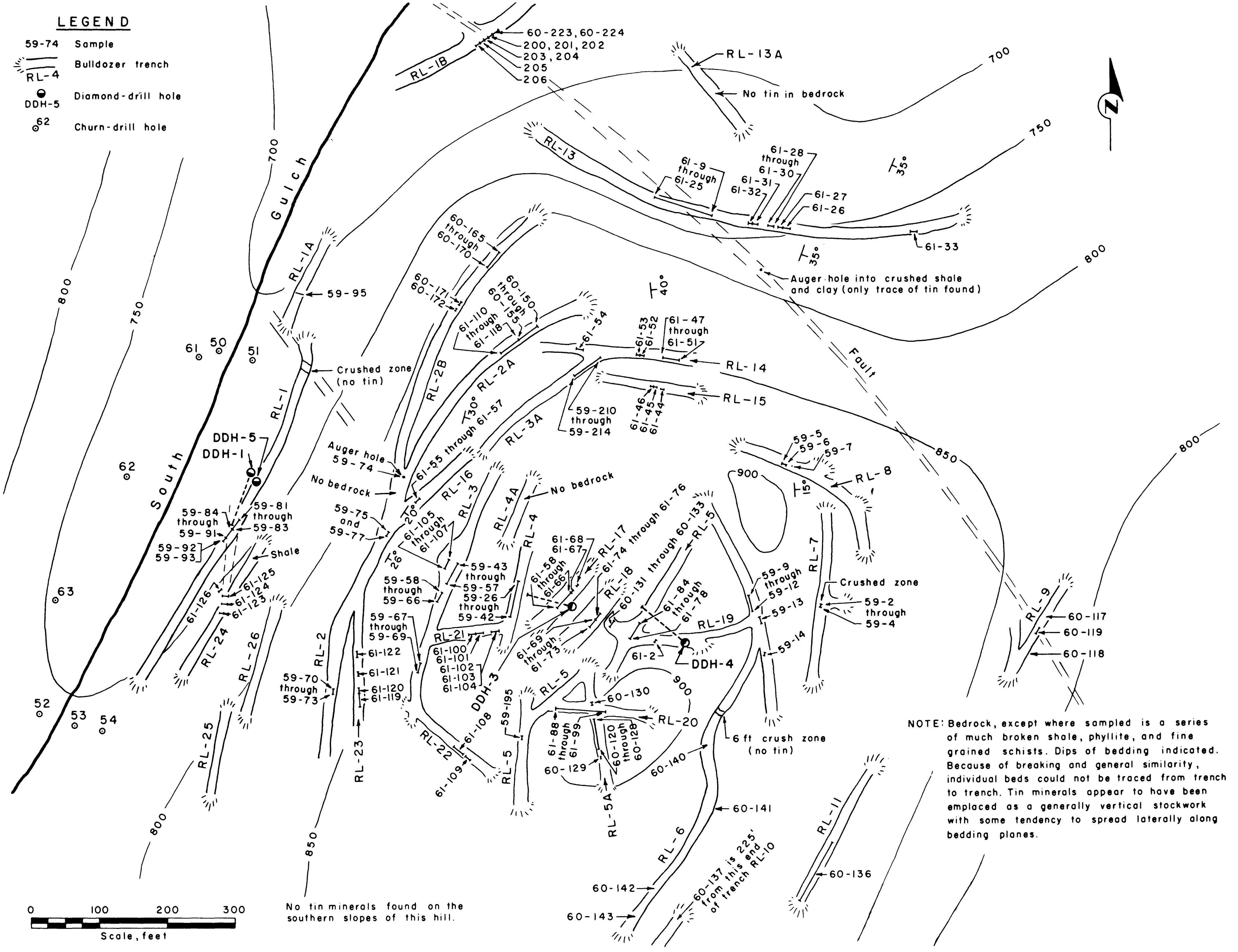
See footnotes at end of table.

TABLE 10. - Description and analyses of trench samples, west side of South Gulch--continued

Description			Analyses		
Sample		Character of material	Tin, per- cent	Spec.[1]	Petro.[2]
Number	Length, feet				
Trench LL-4--continued					
59-122	3	Crushed shale............................	<0.01	-	-
59-123	2	Shale and quartz...........................	.05	-	-
59-124	2	Quartz...................................	.04	X	-
59-125	2	Clay and quartz...........................	.40	X	-
59-126	2	do...................................	.30	X	-
59-127	1	Shale, clay, and quartz....................	.17	-	-
Trench LL-3					
59-132	2.5	Crushed shale with some clay...............	<0.01	-	-
59-133	2	Yellow clay and some quartz................	.03	-	-
59-134	2	Gray clay, shale fragments, and quartz......	<.01	-	-
59-135	2	do...................................	<.01	-	-
Trench LL-2A					
60-188A	7	Shale with some quartz and clay............	0.01	-	-
60-189	5	do...................................	.02	-	-
60-190	5	do...................................	.01	-	-
60-191	5	do...................................	.01	-	-
60-192	4	do...................................	.03	-	-
60-193	4	do...................................	.03	-	-
60-194	5	do...................................	.14	-	-
Total or average	35		.03	-	-
60-188	23	Shale....................................	<0.01	-	-
61-35	5	Shale with quartz veinlets and clay.........	.16	-	-
61-36	5	do...................................	.02	-	-
61-37	5	do...................................	1.19	-	-
61-38	5	do...................................	.04	-	-
61-39	5	do...................................	.14	-	-
61-40	5	do...................................	.39	-	-
61-41	7	do...................................	.24	-	-
61-42	5	do...................................	.07	-	-
Total or average	42		.28	-	-
Trench LL-2					
61-128	6	Crushed altered shale, iron-stained clay, and quartz.	<0.01	X	-
61-129	5	do...................................	.06	X	-
61-130	5	do...................................	.24	X	-
61-131	5	do...................................	2.02	X	-
Total or average	21		.55		
Trench LL-1					
59-97	1	Iron-stained gray shale....................	0.04	-	-
59-98	3	Crushed altered shale, iron-stained clay, and quartz.	.08	-	-
59-99	2	Iron-stained gray shale....................	.03	-	-
60-197	-	Specimen; shale from same place as samples 59-97 and 59-99.	-	-	X
Trench LL-1B					
207	1	Clay-quartz vein..........................	0.06	-	-

[1] See section entitled "Spectrographic Analyses."

[2] See section entitled "Petrography."



NOTE: Bedrock, except where sampled is a series of much broken shale, phyllite, and fine grained schists. Dips of bedding indicated. Because of breaking and general similarity, individual beds could not be traced from trench to trench. Tin minerals appear to have been emplaced as a generally vertical stockwork with some tendency to spread laterally along bedding planes.

FIGURE 12. - Lode Sampling, East Side of South Gulch.

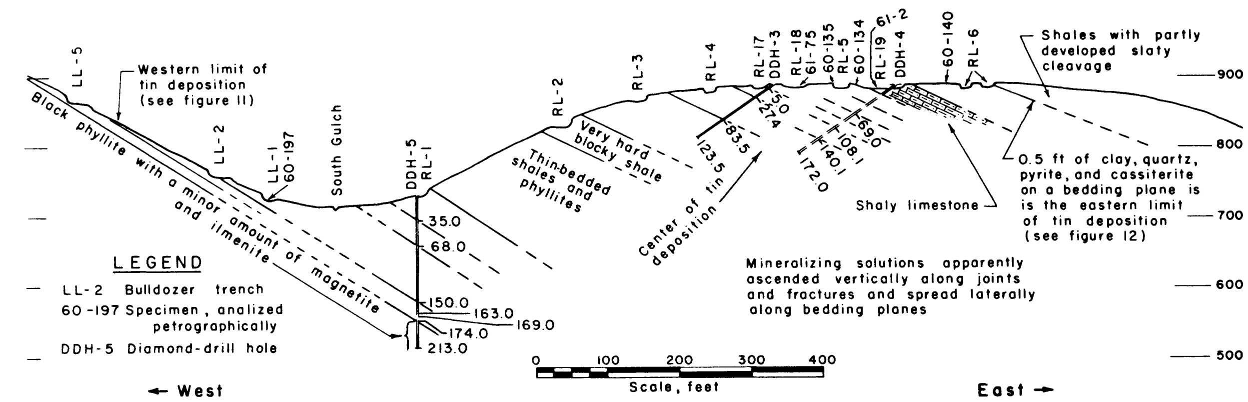


FIGURE 13. - Cross Section Through Diamond-Drill Holes 3, 4, and 5.

Trenches RL-1B, RL-13, and RL-9 exposed a major fault that also was penetrated by a 15-foot auger hole between trenches RL-13 and RL-9. The fault contained a filling of crushed shale and clay but no more than scant traces of tin. Clusters of quartz veins and veinlets along the north wall of the fault (exposed in trenches RL-1B and RL-13) contain up to 0.3 percent tin locally, but average about 0.1 percent tin or less. No identifiable tin mineral was noted in trench RL-9, but analyses indicated 0.01 percent tin.

A crushed zone similar to the major faults was exposed at the north end of trench RL-1. An apparent extension of this zone was found by using an auger in trench RL-2 (sample 59-74). Bedrock could not be exposed in this area because of large hard blocks of schist and shale imbedded in frozen mud. Trench RL-16 was excavated to expose this zone, but was only partially successful. Trench RL-4 could not be excavated to bedrock along the projected strike because of large hard boulders imbedded in frozen mud. No evidences of extensions of this crushed zone were recognized in trenches RL-3 or RL-5.

TABLE 11. - Description and analyses of trench samples, east side of South Gulch

Description			Analyses		
Sample		Character of material	Tin, per- cent	Spec.[1]	Petro.[2]
Number	Length, feet				
		Trench RL-1			
59-81	12	Black shale with about 50 percent quartz veins.	0.03	-	-
59-82	2	do..................................	.07	-	-
59-83	2	do..................................	.04	-	-
59-84	2	Clay, crushed shale, and schist and quartz..	.13	-	-
59-85	2	do..................................	.60	-	-
59-86	2	do..................................	3.00	-	-
59-88	2	do..................................	3.40	-	-

See footnotes at end of table.

TABLE 11. - Description and analyses of trench samples, east side of South Gulch--continued

Description			Analyses		
Sample					
Number	Length, feet	Character of material	Tin, per-cent	Spec.[1]	Petro.[2]
Trench RL-1--continued					
59-89	2	Clay, crushed shale, and schist and quartz..	2.50	-	-
59-90	2	do................................	.12	-	-
59-91	2	do................................	.19	-	-
Total or average	14		1.42	-	-
59-92	2	Broken iron-stained black shale.............	.07	-	-
59-93	4	do................................	.02	-	-
59-94	14	Panned concentrate same place as samples 59-84 to 59-91.	-	X	-
Trench RL-1A					
59-95	2	Quartz vein in black shale..................	0.03	-	-
Trench RL-1B					
60-223	5	Black shale with quartz veinlets............	0.31	-	-
60-224	4	do................................	<.01	-	-
200	3	do................................	.06	-	-
201	.5	Quartz veinlet..............................	.06	-	-
202	1.5	Iron-stained black shale with quartz veinlets.	.09	-	-
Total or average	14		.14	-	-
203	2	Clay, crushed shale, and some quartz........	.09	-	-
204	5	do................................	.06	-	-
Total or average	7		.07	-	-
205	8	Slightly iron-stained schist................	<.01	-	-
206	7	do................................	<.01	-	-
Trench RL-2					
59-70	2	Brown to yellow clay with quartz and partly altered shale at contact between medium soft gray shale (upper bed) and black blocky tourmaline schist (lower bed).	0.02	-	-
59-71	2		.02	X	-
59-72	2		.02	X	-
59-73	2		.02	-	-
59-74	2+	Drilled into crushed zone with a 3-inch auger.	<.01	-	-
59-75	5	Crushed schist and shale....................	<.01	-	-
59-77					
Trench RL-2A					
61-110	4	Altered shale, clay, and quartz.............	0.02	X	-
61-111	4	do................................	.02	X	-
61-112	4	do................................	<.01	X	-
61-114	4	do................................	<.01	X	-
61-115	4	do................................	.03	X	-
61-116	4	do................................	.04	X	-
61-117	5	do................................	.04	-	-
61-118	5	do................................	.04	-	-
60-150	5	do................................	.01	X	-
60-151	5	do................................	.01	X	-

See footnotes at end of table.

TABLE 11. - Description and analyses of trench samples, east side of South Gulch--continued

Description			Analyses		
Sample		Character of material	Tin, per-cent	Spec.[1]	Petro.[2]
Number	Length, feet				
		Trench RL-2A--continued			
60-152	5	Altered shale, clay, and quartz............	0.07	X	-
60-153	5	do..................................	.05	X	-
60-154	5	do..................................	.05	X	-
60-155	5	do..................................	.01	X	-
Total or average	64		.03	-	-
		Trench RL-2B			
60-165	5	Altered shale, clay, and quartz............	0.01	X	-
60-166	5	do..................................	.02	X	-
60-167	5	do..................................	.02	X	-
60-168	5	do..................................	<.01	X	-
60-169	5	do..................................	.01	X	-
60-170	5	do..................................	.01	X	-
Total or average	30		.01	-	-
60-171	3	Varicolored clay and crushed altered shale..	.01	-	-
60-172	2	Broken shale with some clay................	.01	-	-
		Trench RL-24 (Between Trenches RL-1 and RL-2)			
61-123	4	Tourmaline schist, clay, and quartz........	0.08	-	-
61-124	4	do..................................	.07	-	-
61-125	4	do..................................	.06	-	-
61-126	1	Fault filling, dark-green clay.............	<.01	-	-
		Trench RL-23 (South Fork, Trench RL-2)			
61-119	19	Tourmaline schist, shale contact zone......	0.12	-	-
61-120	11	Altered shale, clay, and quartz............	.01	-	-
61-121	5	do..................................	.01	-	-
61-122	7	do..................................	.43	-	-
		Trench RL-16 (Northeast Fork, Trench RL-2)			
61-55	2.5	Shaly fragments and dark-green clay........	0.03	-	-
61-56	4	Black broken tourmaline schist and quartz...	.04	-	-
61-57	3.5	Yellow clay, shaly clay, and quartz........	.14	-	-
		Trench RL-22 (Southeast Fork, Trench RL-3)			
61-108	16	Iron-stained shale, clay, and quartz.......	<0.01	-	-
61-109	9	do..................................	<.01	-	-
		Trench RL-3			
61-105	5	Clay, altered shale, and quartz............	0.06	-	-
61-106	5	do..................................	.16	-	-
61-107	5	do..................................	.03	-	-
59-43	2	Iron-stained shale and quartz..............	<.01	-	-
59-44	2	Clay, altered shale, and quartz............	<.01	-	-
59-45	2	do..................................	<.01	X	-
59-46	2	do..................................	.08	X	-
59-47	2	do..................................	.31	X	-
59-48	2	White to yellow clay and quartz............	1.80	X	-
59-49	2	Clay, altered shale, and quartz............	2.70	X	-
59-50	2	do..................................	1.90	X	-
59-51	2	do..................................	.50	X	-

See footnotes at end of table.

TABLE 11. - Description and analyses of trench samples, east side of South Gulch--continued

Description			Analyses		
Sample		Character of material	Tin, percent	Spec.[1]	Petro.[2]
Number	Length, feet				
		Trench RL-3--continued			
59-52	2	Shale, clay, and quartz....................	0.32	-	-
59-53	2	do................................	<.01	-	-
Total or average	20		.76	-	-
59-54	4	Iron-stained shale with some quartz.........	<.01	-	-
59-55	4	do................................	<.01	-	-
59-56	4	do................................	.02	-	-
59-57	4	do................................	<.01	-	-
Total or average	16		<.01	-	-
59-58	2	Iron-stained clayey shale and quartz........	.05	-	-
59-59	1.5	do................................	.02	-	-
59-60	2	do................................	<.01	-	-
59-61	2	do................................	.02	-	-
59-62	2	do................................	.06	-	-
59-63	2	do................................	.05	-	-
59-64	2	do................................	.30	-	-
59-65	2	do................................	.09	-	-
59-66	2	do................................	.02	-	-
Total or average	17.5		.07	-	-
59-67	3.5	Clay, altered shale, and quartz.............	0.03	-	-
59-68	3.5	do................................	.30	-	-
59-69	8	Clay-quartz veinlets in altered shale.......	.05	-	-
Total or average	15		.10	-	-
		Trench RL-3A			
59-210	10	Iron-stained clayey schist and quartz.......	0.28	-	-
59-211	10	do................................	.16	-	-
59-212	10	do................................	.13	-	-
59-213	10	do................................	.11	-	-
59-214	10	do................................	.53	-	-
Total or average	50		.24	-	-
		Trench RL-14 (East Fork, Trench RL-3A)			
61-47	5	Altered shale, clay, and quartz.............	0.31	-	-
61-48	5	do................................	1.36	-	-
61-49	5	do................................	1.65	X	-
61-50	5	do................................	.37	-	-
61-51	5	do................................	.04	-	-
Total or average	25		.75	-	-
61-52	7	Crushed green shale and black schist, strike N 15°, dip 60° W.	<.01	-	-
61-53	6	do................................	<.01	-	-
61-54	9	Altered shale, clay, and quartz.............	.06	-	-

See footnotes at end of table.

TABLE 11. - Description and analyses of trench samples, east side of South Gulch--continued

Description			Analyses		
Sample		Character of material	Tin, per- cent	Spec.[1]	Petro.[2]
Number	Length, feet				
Trench RL-15 (East Fork, Trench RL-3A)					
61-44	2.5	Iron-stained altered shale and clay.........	0.02	-	-
61-45	3	Altered shale, clay, and quartz.............	.11	-	-
61-46	5	do..................................	<.01	-	-
Trench RL-21 (Between Trenches RL-3 and RL-4					
61-100	10	Iron-stained shale, clay, and quartz........	0.07	-	-
61-101	10	do..................................	.10	-	-
Total or average	20		.08	-	-
61-102	4	Iron-stained altered shale, clay, and quartz	.08	-	-
61-103	5	do..................................	.02	-	-
61-104	4	do..................................	.07	-	-
Total or average	13		.06	-	-
Trench RL-4					
59-26	2	Iron-stained schist, clay, and quartz.......	0.62	X	-
59-27	4	do..................................	.10	X	-
59-28	1.3	do..................................	.02	X	-
59-29	1.7	do..................................	.03	X	-
59-30	4	do..................................	<.01	-	-
59-31	4.7	do..................................	<.01	-	-
59-32	4.3	do..................................	<.01	-	-
59-33	5	do..................................	<.01	-	-
59-34	5	do..................................	<.01	-	-
59-35	2	do..................................	.02	-	-
59-36	2.8	do..................................	.06	-	-
59-37	2.5	do..................................	.99	-	-
59-38	2.5	do..................................	.31	-	-
59-39	4.4	do..................................	<.01	-	-
59-40	2.9	do..................................	.14	-	-
59-41	2	do..................................	3.00	-	-
59-42	3	do..................................	1.42	-	-
Total average	54.1		.40		
Trench RL-17 (Between Trenches RL-4 and RL-5)					
61-58	4	Altered shale, iron-stained clay, and quartz	<0.01	-	-
61-59	4	do..................................	.01	-	-
61-60	4	do..................................	.16	-	-
61-61	4	Gray to red-brown clay, altered shale, and quartz.	4.96	-	-
61-62	4.5	White, yellow, and pale-green clay..........	3.37	-	-
61-63	4.5	Gray altered shale, clay, and quartz........	1.68	-	-
61-64	2	White to yellow clay, altered shale, and shale, and quartz.	.18	-	-
61-65	3	do..................................	.12	-	-
61-66	4	do..................................	.53	-	-
Total or average	34		1.36	-	-
61-67	4	Iron-stained, dark-gray shale...............	.01	-	-
61-68	2	Shale, quartz, and clay.....................	.01	-	-

See footnotes at end of table.

TABLE 11. - Description and analyses of trench samples, east side of South Gulch--continued

Description			Analyses		
Sample					
Number	Length, feet	Character of material	Tin, percent	Spec.[1]	Petro.[2]
		Trench RL-18 (Between Trenches RL-4 and RL-5)			
61-69	3.5	Altered shale, iron-stained clay, and quartz	0.11	-	-
61-70	3.5	do..................................	.02	-	-
61-71	2	do..................................	.07	-	-
61-72	2	do..................................	.19	-	-
61-73	2.5	do..................................	1.23	-	-
Total or average	13.5		.30	-	-
61-74	5.5	Tourmaline schist and quartz-pyrite veins...	9.88	-	-
61-76	6	do..................................	5.32	-	-
Total or average	11.5		7.50	-	-
61-75	-	Tourmaline schist and quartz-pyrite vein, selected specimens from the same place as 61-74.	-	-	X
		Trench RL-5			
60-131	2	Iron-stained altered shale, clay, and quartz	0.05	-	-
60-132	2	do..................................	1.56	-	-
60-133	4	do..................................	.06	-	-
Total or average	8		.43	-	-
61-78	3.5	Black shale with some clay and quartz.......	.01	-	-
61-79	3	do..................................	<.01	-	-
61-80	3	White, gray, and iron-stained clay, altered shale, and quartz.	.20	-	-
61-81	2	do..................................	9.18	X	-
61-82	2	do..................................	6.50	-	-
61-83	3	do..................................	4.18	-	-
61-84	2.5	do..................................	4.34	-	-
Total or average	19		2.92	-	-
60-134	-	Specimen; wallrock north of sample 61-78....	-	-	X
60-135	-	Specimen; wallrock south of sample 61-84....	-	-	X
59-195	.5	Quartz veinlet in shale....................	.08	X	-
		Trench RL-5A			
60-120	5	Altered shale, quartz, and iron-stained clay	0.24	-	-
60-121	5	do..................................	.03	-	-
60-122	5	do..................................	1.47	-	-
60-123	5	do..................................	.16	-	-
60-124	5	do..................................	.01	-	-
60-125	5	do..................................	.02	-	-
60-126	5	do..................................	.01	-	-
60-127	5	do..................................	<.01	-	-
60-128	5	do..................................	.01	-	-
Total or average	45		.22	-	-
60-129	.2	Quartz veinlet............................	.66	-	-
60-130	5	Quartz lens in shale......................	.01	-	-
59-203	-	Panned concentrate from same place as samples 60-120 through 60-128.	-	X	-

See footnotes at end of table.

TABLE 11. - Description and analyses of trench samples, east side of South Gulch--continued

Description			Analyses		
Sample					
Number	Length, feet	Character of material	Tin, per- cent	Spec.[1]	Petro.[2]
Trench RL-20 (East Fork, Trench RL-5A)					
61-88	5	Altered shale, quartz, and clay............	<0.01	-	-
61-89	5	do..................................	<.01	-	-
61-90	5	do..................................	<.01	-	-
61-91	5	do..................................	<.01	-	-
61-92	5	do..................................	.01	-	-
61-93	5	do..................................	.02	-	-
61-94	5	do..................................	<.01	-	-
61-95	5	do..................................	<.01	-	-
61-96	5	do..................................	<.01	-	-
61-97	5	do..................................	<.01	-	-
61-98	5	do..................................	<.01	-	-
61-99	5	do..................................	<.01	-	-
Trench RL-19 (Between Trenches Rl-5 and RL-6)					
61-2	-	Specimen; veinlet 0.5 foot wide............	-	-	X
Trench RL-6					
60-140	-	Specimen; hard fine-grained black shale.....	<0.01	-	X
60-141	-	Specimen; black fissile shale and quartz veins.	<.01	-	X
60-142	-	Specimen; iron-stained shale, some clay, and quartz.	<.01	-	X
60-143	-	Specimen; dark-gray slaty shale............	<.01	-	X
59-9	2	Crushed shale and quartz..................	.02	-	-
59-10	1	do..................................	.02	-	-
59-11	9	Limy shale with quartz veinlets............	<.01	-	-
59-12	8	do..................................	<.01	-	-
59-13	10	Iron-stained shale, clay, and quartz........	.59	-	-
59-14	1	Crushed shale, quartz, and clay............	<.01	-	-
Trench RL-7					
59-2	2	Crushed shale, some clay..................	0.06	-	-
59-3	1	do..................................	.06	-	-
59-4	1	Iron-stained shale........................	.02	-	-
Trench RL-8					
59-5	2.5	Iron-stained shale, clay, and quartz........	0.76	-	-
59-6	2.5	do..................................	.55	-	-
Total or average	5		.66	-	-
59-7	.5	Clay and quartz veinlet....................	.02	-	-
Trench RL-9					
60-117	1	Specimen of 1-foot quartzite bed in shale...	<0.01	-	X
60-118	-	Specimen of black shale...................	.01	-	-
60-119	12	Clay and crushed shale, little quartz.......	.01	-	-
Trench RL-10					
60-137	200	Black shale with a few quartz lenses.......	<0.01	-	-
Trench RL-11					
60-136	100	Black shale with a few quartz lenses.......	<0.01	-	-

See footnotes at end of table.

TABLE 11. - Description and analyses of trench samples, east side of South Gulch--continued

Description			Analyses		
Sample		Character of material	Tin, per- cent	Spec.[1]	Petro.[2]
Number	Length, feet				
		Trench RL-13			
61-9	4	Crushed altered shale, iron-stained clay, and quartz.	<0.01	-	-
61-10	5	do..................................	<.01	-	-
61-11	8	do..................................	.02	-	-
61-12	5	do..................................	<.01	-	-
61-13	3	do..................................	.02	-	-
61-14	5	do..................................	.05	-	-
61-15	5	do..................................	.03	-	-
61-16	5	do..................................	<.01	-	-
61-17	5	do..................................	<.01	-	-
61-18	4	do..................................	<.01	-	-
61-19	6	do..................................	<.01	-	-
61-20	5	do..................................	<.01	-	-
61-21	5	do..................................	<.01	-	-
61-22	5	do..................................	.11	-	-
61-23	5	do..................................	.03	-	-
61-24	5	do..................................	.02	-	-
61-25	5	do..................................	.12	-	-
Total or average	85		.02	-	-
61-26	9	Shale with clay and quartz veinlets.........	<.01	-	-
61-27	6	do..................................	<.01	-	-
61-28	4	Altered black shale with clay and quartz....	.01	-	-
61-29	4	do..................................	.06	-	-
61-30	4	do..................................	<.01	-	-
Total or average	12		.02	-	-
61-31	6	Shale with quartz and clay veinlets.........	<.01	-	-
61-32	6	do..................................	<.01	-	-
61-33	10	Shale with some clay and quartz............	<.01	-	-

[1] See section entitled "Spectrographic Analyses."
[2] See section entitled "Petrography."

Diamond Drilling Results

Diamond-Drill Hole 1. - DDH-1 was drilled directly under a clay-quartz-cassiterite outcrop exposed in trench RL-1 (fig. 12 and table 12). It was not possible to trace the outcropping under the deep overburden in South Gulch, but it was thought that the deposit was alined with a westward-trending vertical fracture encountered in trenches LL-1 and LL-2. The hole did not intersect a downward extension of the deposit in trench RL-1. The deposit apparently is a pod or lens of limited linear extent. Core recovery was poor, but sludge was collected at all times.

Diamond-Drill Hole 2. - DDH-2 was drilled to intersect a quartz-cassiterite deposit which, at the time the hole was drilled, was partly exposed in trenches LL-2A through LL-5 (figs. 11 and 13 and table 13). The objective was to determine the dip of the metasediments and of the tin deposit and to obtain a sample below the zone of surface concentration. Little tin was detected. This suggested that the relatively high-grade material encountered in the trenches resulted from residual concentration. The trenches therefore were dug several feet into bedrock before sampling. Combined trenching and drilling results indicated a deposit alined with metasedimentary bedding.

Diamond-Drill Hole 3. - DDH-3 (figs. 12 and 13 and table 14) was drilled to determine the dip of the quartz-cassiterite deposit exposed in trench RL-4. At the time the hole was started, evidence indicated that this was a zone of veinlets alined with the metasedimentary bedding. Drilling results indicated that this was not the case. The first 20 feet of hole penetrated a zone containing abundant tin minerals. When this hole was completed, trenches RL-17 and RL-18 were excavated and exposed an irregular high-grade concentration of tin minerals along a westward-trending vertical fracture.

Diamond-Drill Hole 4. - DDH-4 (figs. 12 and 13 and table 15) was drilled to determine if the tin minerals in trenches RL-5 and RL-5A were parts of a lode deposit alined with and underlying the eastward-dipping limy shales exposed east of trench RL-5 (fig. 13). The hole was angled so that it would also intersect the eastward extension of a line drawn through the tin-bearing zone encountered in trench RL-4, DDH-3, and trench RL-5; results indicated that this tin-bearing zone did not extend to the east of trench RL-5. No definable lode deposit alined with bedding was found under the shaly limestone. The hole intersected a generally low-grade stockwork of quartz-clay-cassiterite minerals in tourmalinized tin-bearing rock.

Diamond-Drill Hole 5. - DDH-5 (figs. 12 and 13 and table 16) was drilled to intersect the sedimentary beds that cropped out under deep overburden between trenches LL-1 and RL-1. The object was to determine if these beds contained tin deposits alined on bedding. The hole was continued until it intersected magnetite-bearing beds previously intersected by DDH-2, and exposed in the adjacent trenches (fig. 11). No definable lode deposit was encountered. The hole penetrated a widespread low-grade zone of quartz veins with clay, pyrite, and arsenopyrite in tourmalinized rock. The bottom of this hole is about 380 feet below the tin outcroppings in trenches RL-4 and RL-5 (figs. 12 and 13). No evidence was noted that would indicate that the bottom of the hole was close to a granitic intrusive.

Summary, Diamond-Drill Holes 1 Through 5. - The drilling results, coupled with the trenching results, indicate that, in the South Gulch area, tin occurs disseminated in an irregular stockwork of veins and veinlets of quartz, clay, cassiterite, pyrite, and arsenopyrite associated with tin-bearing tourmaline schists. The stockwork in this area appears to be independent of the major faults. The northern and southern limits of deposition are vaguely defined. The western limit of deposition generally coincides with a black phyllite containing minor amounts of ilmenite, magnetite, and pyrrhotite that was cut by diamond-drill holes 2 and 5 (figs. 11 and 13 and tables 13 and 16). The eastern limit of tin deposition (except for a small amount of tin in trenches RL-6 and RL-8) is a shaly limestone cut by diamond-drill hole 4 and trench RL-19 (figs. 12 and 13 and table 15). None of the drill holes encountered evidences of granitic intrusives like those found in the Cape Mountain and Lost River tin-bearing areas.

TABLE 12. - Diamond-drill-hole log and sample analyses, hole 1

Location: See figure 12
Elevation of collar: 729 feet
Depth: 141.2 feet
Dip: -36°
Bearing: S 28°00' W

Date begun: July 1, 1961
Date finished: July 26, 1961
Core sizes: AX to 74.0 feet
EX to 141.2 feet

Footage			Percent				Formation
From-	To-	Interval	Core recovery	Tin in sludge	Tin in core	Tin average	
0.0	9.0	9.0	-	-	-	-	Overburden.
9.0	20.0	11.0	74	0.03	0.01	0.02	Fractured, thin-bedded black iron-stained shale with a clay-quartz vein from 18 to 19 feet and clay in other fractures.
20.0	30.0	10.0	14	.03	<.01	.02	Clay, black shale, and schist with some quartz. Some tourmaline in the shale.
30.0	47.0	17.0	72	.02	-	-	Fine-grained blocky black tourmaline schist with thin quartz-pyrite veinlets and thin veinlets of calcite along some fractures.
47.0	57.6	10.6	33	.07	.04	.06	Fine-grained, hard, blocky black tourmaline schist with quartz-pyrite veinlets up to 1 inch wide and a few thin calcite veinlets in fractures.
57.6	74.0	16.4	64	.05	.04	.05	Fine-grained, hard, blocky black tourmaline schist with few quartz-pyrite or calcite veinlets and no visible bedding.
74.0	90.0	16.0	67	.02	-	-	Hard black shale with little quartz or pyrite and no visible bedding.
90.0	116.2	26.2	29	.11	.01	.10	Broken black tourmaline schist with clay, quartz-pyrite veins, and calcite veins.
116.2	141.2	25.0	48	.03	-	-	Broken black tourmaline schist with some gray clay and a few very thin veinlets of quartz, pyrite, and calcite.

TABLE 13. - Diamond-drill-hole log and sample analyses, hole 2

Location: See figure 11
Elevation of collar: 778 feet
Depth: 114.4 feet
Dip: -35°
Bearing: N 80° W

Date begun: July 27, 1961
Date finished: Aug. 4, 1961
Core sizes: BX to 8.3 feet
AX to 114.4 feet

Footage			Percent				Formation
From-	To-	Interval	Core recovery	Tin in sludge	Tin in core	Tin average	
0.0	18.2	18.2	18	0.01	-	-	Broken light-gray phyllite with numerous dark spots about 1/16 inch in diameter composed of tourmaline and ilmenite. Iron stain on fractures.
18.2	25.7	7.5	31	.03	-	-	Similar spotted phyllite but more clay, iron stain, and quartz and some tourmaline.
25.7	33.6	7.9	66	.03	-	-	Darker gray similar spotted phyllite with some quartz, tourmaline, and iron-stained clay and a trace of pyrite.
33.6	54.3	20.7	67	.01	-	-	Medium-gray phyllite with numerous 1/16 inch spots of tourmaline and ilmenite. Quartz-pyrite veinlets present but scarce.
54.3	65.0	10.7	83	.03	0.04	0.03	Medium-gray tourmalinized phyllite with veinlets containing abundant muscovite and quartz and less goethite, limonite, pyrrhotite, and pyrite. There is a contact with a lower bed at 58.3 feet but veinlets extend into this bed.
65.0	114.4	49.4	78	<.01	-	-	Dark-gray to black relatively unbroken phyllite with minor amounts of magnetite and ilmenite and a small amount of tourmaline. A few quartz-pyrite veinlets extend to 84.0 feet.

TABLE 14. - Diamond-drill-hole log and sample analyses, hole 3

Location: See figures 12 and 13	Date begun: Aug. 5, 1961
Elevation of collar: 888 feet	Date finished: Aug. 15, 1961
Depth: 123.5 feet	Core sizes: AX to 76.2 feet
Dip: -35°	EX to 123.5 feet
Bearing: N 73°30' W	

Footage			Percent				Formation
From-	To-	Interval	Core recovery	Tin in sludge	Tin in core	Tin average	
0.0	5.0	5.0	-	-	-	-	Overburden.
5.0	10.0	5.0	12	-	0.90	-	Broken tourmalinized shale, with clay, quartz, calcite, pyrite, arsenopyrite, and cassiterite. Cassiterite may have been upgraded by residual concentration on the frost-broken outcropping. No sludge recovered.
10.0	19.9	9.9	14	0.38	.71	0.40	Yellow to white clay, tourmaline schist, and quartz with aluminite and chlorite abundant and some limonite, hematite, cassiterite, hydromuscovite, and magnetite.
19.9	27.4	7.5	37	.02	.01	.02	Broken black to iron-stained shale with gray clay, brown clay, chlorite, quartz, gypsum, and limonite.
27.4	41.6	14.2	56	<.01	<.01	<.01	Black shale with some quartz and pyrite from 39.0 to 41.6 feet.
41.6	71.0	29.4	83	<.01	-	-	Black biotite phyllite with some included magnetite cut by a few quartz-pyrite veinlets.
71.0	83.5	12.5	73	<.01	-	-	Black shale with some clay and small amounts of chlorite, limonite, and calcite.
83.5	123.5	40.0	61	<.01	-	-	Dark-gray shale with a few small quartz-pyrite veinlets and a trace of cassiterite with quartz at 113.5 to 114.0 feet

TABLE 15. - Diamond-drill-hole log and sample analyses, hole 4

Location: See figures 12 and 13	Date begun: Aug. 16, 1961
Elevation of collar: 894 feet	Date finished: Aug. 29, 1961
Depth: 172 feet	Core sizes: BX to 2.0 feet
Dip: -37°	AX to 41.6 feet
Bearing: N 49° W	EX to 172.0 feet

Footage			Percent				Formation
From-	To-	Interval	Core recovery	Tin in sludge	Tin in core	Tin average	
0.0	23.9	23.9	39	<0.01	-	-	Intensely broken black medium-hard shaly limestone and some tourmalinized shale with a few quartz and calcite veinlets. Well-crystallized gypsum occurs with clay and limonite along fractures. Some chlorite is present.
23.9	47.9	24.0	48	<.01	-	-	Black, slightly graphitic limy shale with small calcite veinlets and some iron stain on fractures. A few quartz veinlets also are present and fractures contained a clay filling. Calcareous material most abundant in lenticles up to ¼ inch thick alined with bedding.
47.9	69.0	21.1	68	<.01	-	-	Black, slightly graphitic shale with tiny calcite veinlets.
69.0	82.0	13.0	74	.02	-	-	Gray altered shale with gypsum in iron-stained, clay-filled fractures and a few quartz-pyrite veinlets. Biotite is abundant and part of the shale has been altered to a hornfels.
82.0	89.2	7.2	46	.02	0.03	0.02	Broken shale, shaley clay, clay, quartz, calcite, and gypsum.
89.2	95.9	6.7	96	.01	-	-	Gray shale with iron-stained joints and fractures and some quartz veinlets.

TABLE 15. - Diamond-drill-hole log and sample analyses, hole 4--continued

Location: See figures 12 and 13	Date begun: Aug. 16, 1961
Elevation of collar: 894 feet	Date finished: Aug. 29, 1961
Depth: 172 feet	Core sizes: BX to 2.0 feet
Dip: -37°	AX to 41.6 feet
Bearing: N 49° W	EX to 172.0 feet

Footage			Percent				Formation
From-	To-	Interval	Core recovery	Tin in sludge	Tin in core	Tin average	
95.9	108.1	12.2	64	<0.01	-	-	Soft gray shale with clay, calcite, and gypsum in fractures with a few small quartz veinlets.
108.1	116.2	8.1	95	.05	0.04	0.04	Gray medium-hard shale with a few clay veinlets and quartz veinlets.
116.2	140.1	23.9	74	.34	.26	.31	Broken tourmaline schist with numerous quartz veins and veinlets, calcite veinlets, and fractures filled with iron-stained clay and some gypsum. Pyrite is common in both clay and harder rock and some limonite is present. Cassiterite occurs as random, very fine grains within the tourmaline schist. In 3 fragments of core examined (131.0 feet, 136.0 feet, 138.0 feet) over 95 percent of the cassiterite grains were smaller than 600-mesh. Some chlorite fragments also noted.
140.1	172.0	31.9	45	.03	.03	.03	Shale grading from intensely altered, broken, and stained at 140 feet to hard gray shale at 172 feet. Clay and limonite abundant from 140 to 150 feet. Calcite, gypsum, epidote, and chlorite also occur at 140 to 150 feet. A few quartz veins and veinlets with some pyrite noted to about 168 feet.

TABLE 16. - Diamond-drill-hole log and sample analyses, hole 5

Location: See figures 12 and 13
Elevation of collar: 724 feet
Depth: 213.0 feet
Dip: Vertical
Bearing: ---

Date begun: Aug. 30, 1961
Date finished: Sept. 13, 1961
Core sizes: BX to 7.6 feet
AX to 75.0 feet
EX to 213.0 feet

Footage			Percent				Formation
From-	To-	Interval	Core recovery	Tin in sludge	Tin in core	Tin average	
0.0	35.0	35.0	29	0.07	0.07	0.07	Broken gray to dark-gray tourmaline schist with abundant quartz, minor amounts of pyrite, goethite, arsenopyrite, and magnetite and a trace of gypsum.
35.0	68.0	33.0	35	.02	-	-	Hard black shale cut by an occasional quartz veinlet with a little pyrite or by small clay-filled fractures. A few beds contain chlorite.
68.0	150.0	82.0	26	.02	-	-	Hard, much jointed dark-gray to black shales (some might be called schists) with much tourmalinization cut by occasional quartz-pyrite and calcite veinlets.
150.0	163.8	13.8	36	.02	-	-	Gray shale to chlorite schist with tourmaline and quartz-pyrite-arsenopyrite veinlets.
163.8	169.0	5.2	46	.04	-	-	Tourmaline schist with quartz-pyrite-arsenopyrite veins or veinlets and calcite veinlets and some fragments of chlorite schist.
169.0	174.0	5.0	8	.03	-	-	Only tourmalinized black shale fragments recovered.
174.0	213.0	39.0	18	.02	-	-	Black, much broken phyllite with abundant sericite and biotite and a few calcite veinlets. Minor to trace amounts of magnetite, ilmenite, and pyrrhotite are present.

Peluk Creek Area

Detrital cover sampling (fig. 10) indicated that scattered traces of tin were derived from the left limit banks at the mouth of Peluk Creek and that some tin was derived from the divide between Peluk Creek and West Fork. The placer tin deposits at the mouth of Peluk Creek probably derived from these areas because no tin minerals were found at any other place in the Peluk Creek drainage basin.

The tin found in the detrital cover on the left limit bank at the mouth of Peluk Creek occurred as cassiterite attached to or associated with a few scattered quartz veinlets having a maximum width of about 2 inches. Similar veinlets were exposed in the bed of Peluk Creek (samples 60-3 and 60-4, table 17). No additional work was done on the left limit of Peluk Creek.

TABLE 17. - Description and analyses of trench samples, Peluk Creek area

Description			Analyses		
Sample					
Number	Length, feet	Character of material	Tin, percent	Spec.[1]	Petro.[2]
Trench Peluk 5					
60-215	9	Hard, blocky shale....................	0.01	-	-
60-216	6	Medium-soft iron-stained shale with secondary cleavage.	.01	-	-
60-217	2	Very soft gray shale.................	.01	-	-
60-218	6	Clay, quartz, pyrite, cassiterite.....	3.13	-	-
60-219	20	Medium-hard iron-stained shale........	<.01	-	-
60-220	8	Medium-hard iron-stained shale with quartz veinlets.	.17	-	-
Total or average[3]	36		.56	-	-
60-221	6	Crushed zone (fault).................	.02	-	-
60-222	4	Soft iron-stained shale..............	.01	-	-
60-30	-	Pan concentrate......................	37.90	X	X
Other areas					
60-3	-	Specimen shale bedrock in Peluk Creek 50 feet upstream from mouth.	-	-	X
60-4	-	Quartz veinlets cutting the shale bedrock (60-3).	-	-	X

[1] See section entitled "Spectrographic Analyses."

[2] See section entitled "Petrography."

[3] This series of samples was taken across the highest grade zone indicated by detrital cover sampling. Lesser amounts of tin occur along the fault for about 100 feet to the northwest, and traces extend about 200 feet farther. Only a trace of tin was found in trench Peluk 6 which crosses the fault 100 feet to the southeast. Sample 60-218 represents a roughly lenticular zone of enrichment within the tin-bearing area. The long dimension of the lens is about 25 or 30 feet. Detrital cover sampling results indicate that this is the only such zone of enrichment in this area.

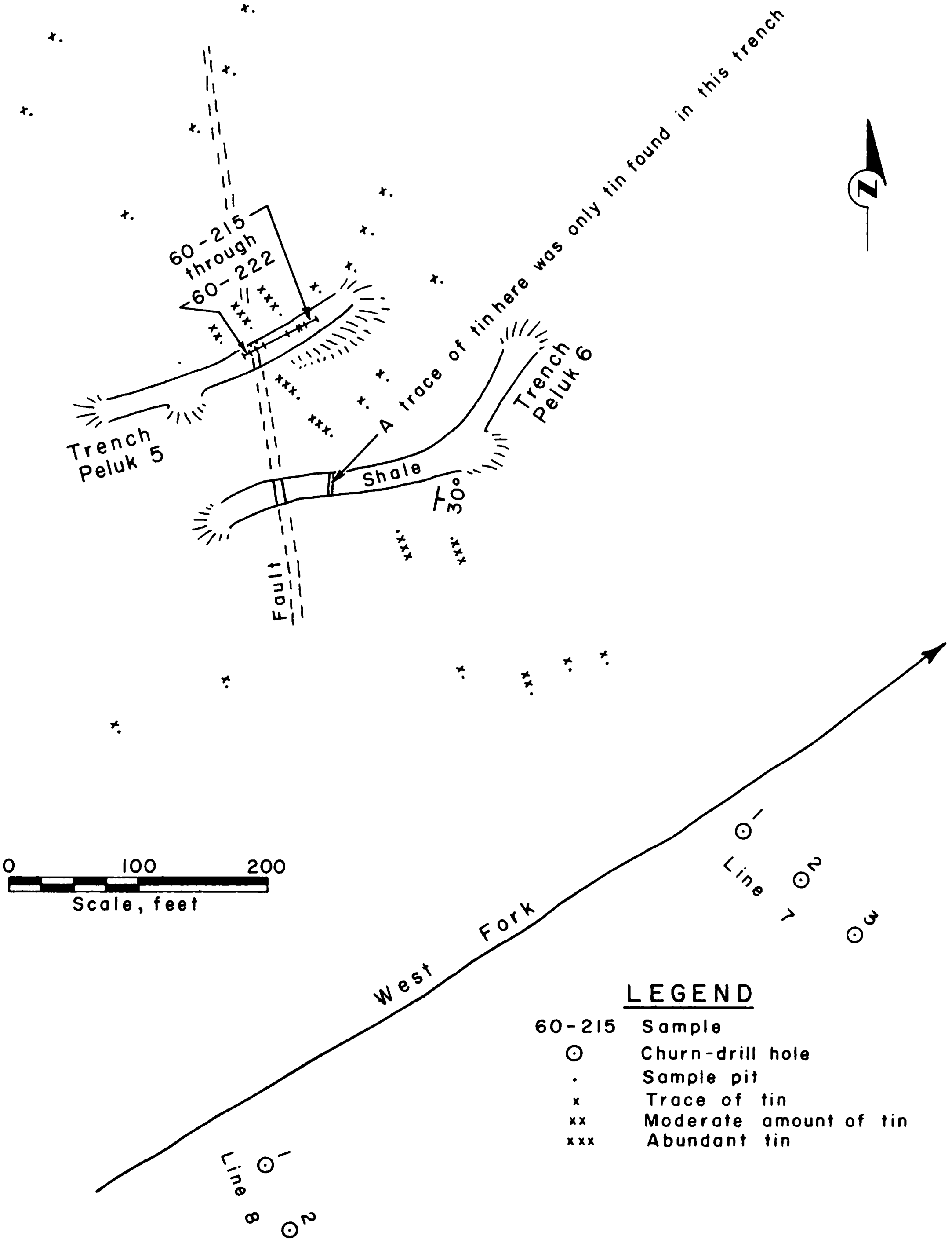


FIGURE 14. - Lode Sampling, Peluk Creek Area.

Detrital cover sampling was continued on the right limit of Peluk Creek and the left limit of West Fork. A tin occurrence was outlined almost on the summit of the Peluk Creek-West Fork divide. Trench Peluk 5 (fig. 14 and table 17) exposed the deposit where detrital cover sampling indicated the highest grade. The cassiterite occurred associated with quartz, sulfide minerals, and clay, in an irregular zone or cluster of veinlets and lenses in the metasediments along a northwestward-trending fault. Only a trace of tin was found in trench Peluk 6 that crosses the fault 100 feet to the southeast. Detrital cover sampling indicated that minor to trace amounts of tin occur along the fault for 300 feet to the northwest. No other work was done in the area.

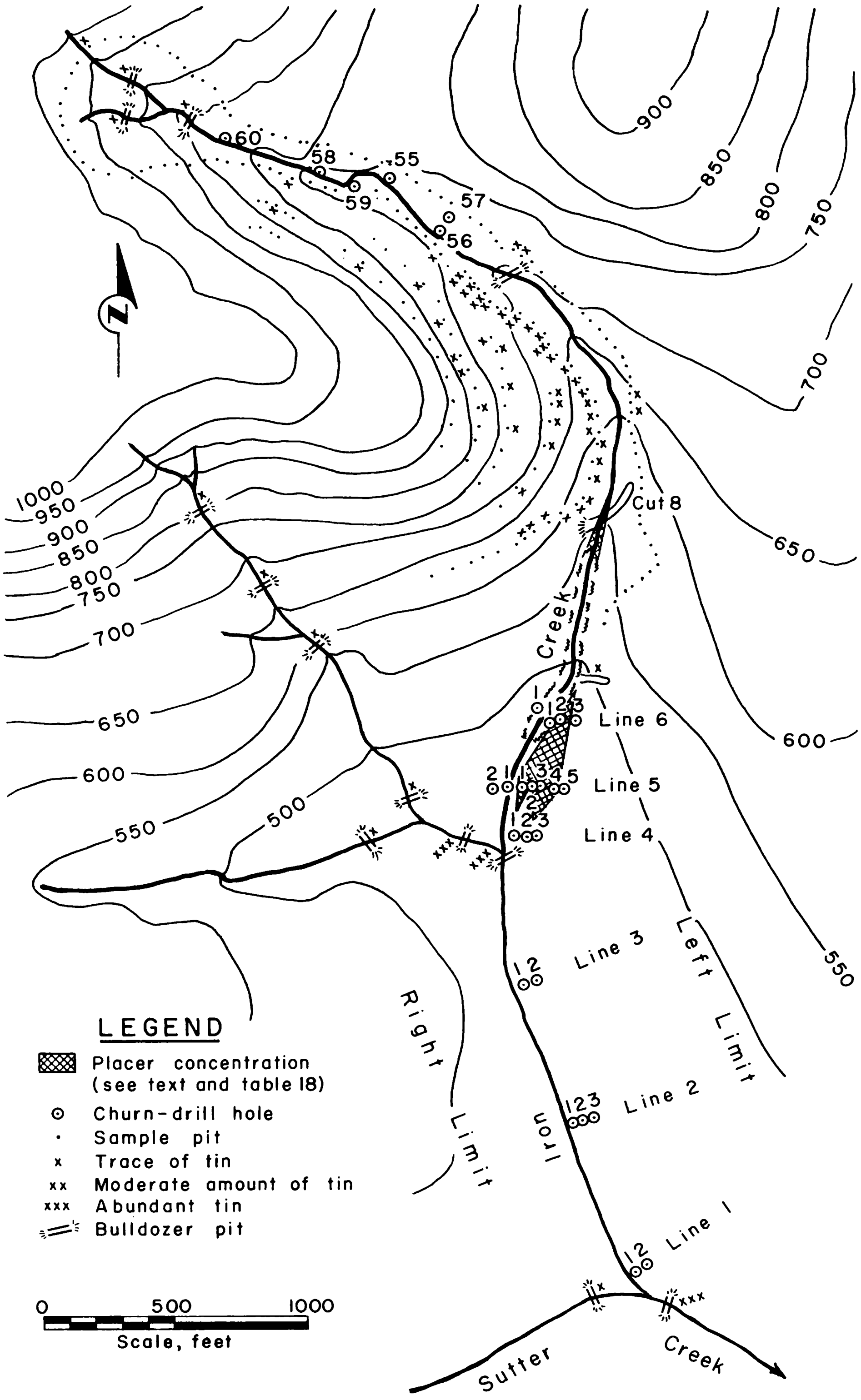


FIGURE 15. - Placer and Detrital Cover Sampling, Sutter Creek and Iron Creek.

Sutter Creek, Iron Creek Drainage Basin

Placer Sampling, Iron Creek

The results of Bureau of Mines 1943 churn drilling on Sutter Creek and Iron Creek (figs. 3 and 15 and table 18) indicated that a placer tin deposit extended from the mining pit at the mouth of Sutter Creek upstream to the mouth of Iron Creek, and up Iron Creek to the base of Big Potato Mountain. On Sutter Creek, the grade is uniformly low (table 6). Examination of Sutter Creek indicated that no tin occurs in the banks or in tributaries below Iron Creek. Only traces of tin were found in Sutter Creek above Iron Creek. The grade of the deposit on Iron Creek is greatest near the base of Big Potato Mountain, and drops as it extends downstream.

TABLE 18. - Churn-drilling results, 1943, Iron Creek[1]

Line and hole	Mining section, feet	Tin lb per cu yd	Abundance factor[2]
Line 1:			
1	2.0	0.83	166
2	3.0	.15	45
Line 2:			
1	.0	Trace	Trace
2	5.0	.40	200
3	.0	Trace	Trace
Line 3:			
1	.0	Trace	Trace
2	.0	Trace	Trace
Line 4:			
1	5.5	.24	132
2	6.0	.45	270
3	11.0	.06	66
Line 5:			
2 (RL)	.0	Trace	Trace
1 (RL)	5.0	1.01	505
1 (LL)	6.5	.15	97
2 (LL)	6.0	.12	72
3 (LL)	8.0	.89	712
4 (LL)	6.0	1.32	792
5 (LL)	10.0	.09	90
Line 6:			
1 (RL)	7.0	.11	77
1 (LL)	7.0	.30	210
2	10.0	.86	860
3	.0	Trace	Trace
Cut 8	4.7	3.38	1,585

[1] Data from Bureau of Mines Report of Investigations 4418 (30) except last column.

[2] (Mining section, feet) x (tin, lb per cu yd) x 100 = abundance factor. See section of this report entitled "Placer Sampling and Evaluation."

Obviously, the tin in the Sutter Creek-Iron Creek drainage was derived from the area drained by Iron Creek. Six churn-drill holes (fig. 15 and table 19) were put down on Iron Creek upstream from the previous Bureau drill holes. Bulldozer trenches and shovel pits were dug in the extreme headwaters of Iron Creek and in its right limit tributary. Little more than traces of tin were found. This placer sampling program indicated that the tin must have been derived from the area where Iron Creek rounds the eastern slope of Big Potato Mountain.

TABLE 19. - Churn-drilling results, headwaters of Iron Creek

Hole No.	Drill-hole depth, feet					Concentrate		Mining section[1]			
	Total	Overburden	Gravel	Bedrock	Cased	Weight, lb	Tin, percent	Depth, feet	Vol, cu yd	Tin, lb per cu yd	Abundance factor[2]
55	21.4	-	18.5	2.9	4.0	4.17	0.05	19.0	0.089	0.02	38
56	15.7	-	12.5	3.2	6.0	1.64	2.01	13.0	.061	.54	702
57	16.0	-	13.0	3.0	5.0	2.19	.26	14.0	.066	.09	126
58	30.0	-	24.0	6.0	5.0	7.15	.14	25.0	.117	.09	225
59	26.8	-	-	26.8	3.0	31.79	-	-	.125	-	-
60	23.0	-	15.0	8.0	15.0	3.80	.03	16.0	.137	.01	16

[1] Average volume of drill hole is 0.00854 cubic yard per linear foot of cased drill hole, and 0.00468 cubic yard per linear foot of uncased drill hole.

[2] (Mining section, feet) x (tin, lb per cu yd) x 100 = abundance factor. See section of this report entitled "Placer Sampling and Evaluation."

Detrital Cover Sampling, Iron Creek

The detrital cover on both banks of Iron Creek was sampled as indicated in figure 15. The only significant occurrence of tin was found near the eastern base of Big Potato Mountain. A relatively dense grid of detrital cover samples failed to indicate the presence of strong concentrations at any point.

Lode Sampling, Iron Creek Area

Examination of the tin-bearing area on the eastern base of Big Potato Mountain revealed that the tin minerals occur associated with quartz, pyrite, and arsenopyrite in veinlets in the metasediments both adjacent to and between two major faults (fig. 16). No concentrations were found that would indicate the presence of a large lode outcropping; few trenches were excavated. The two major faults, the Adit Fault and the Daisy Fault, were exposed at several points. Sample locations in trenches IC-1 through IC-5 and trench LL-2 through LL-5 are on figure 16. The Adit Fault was traced from the head of the placer

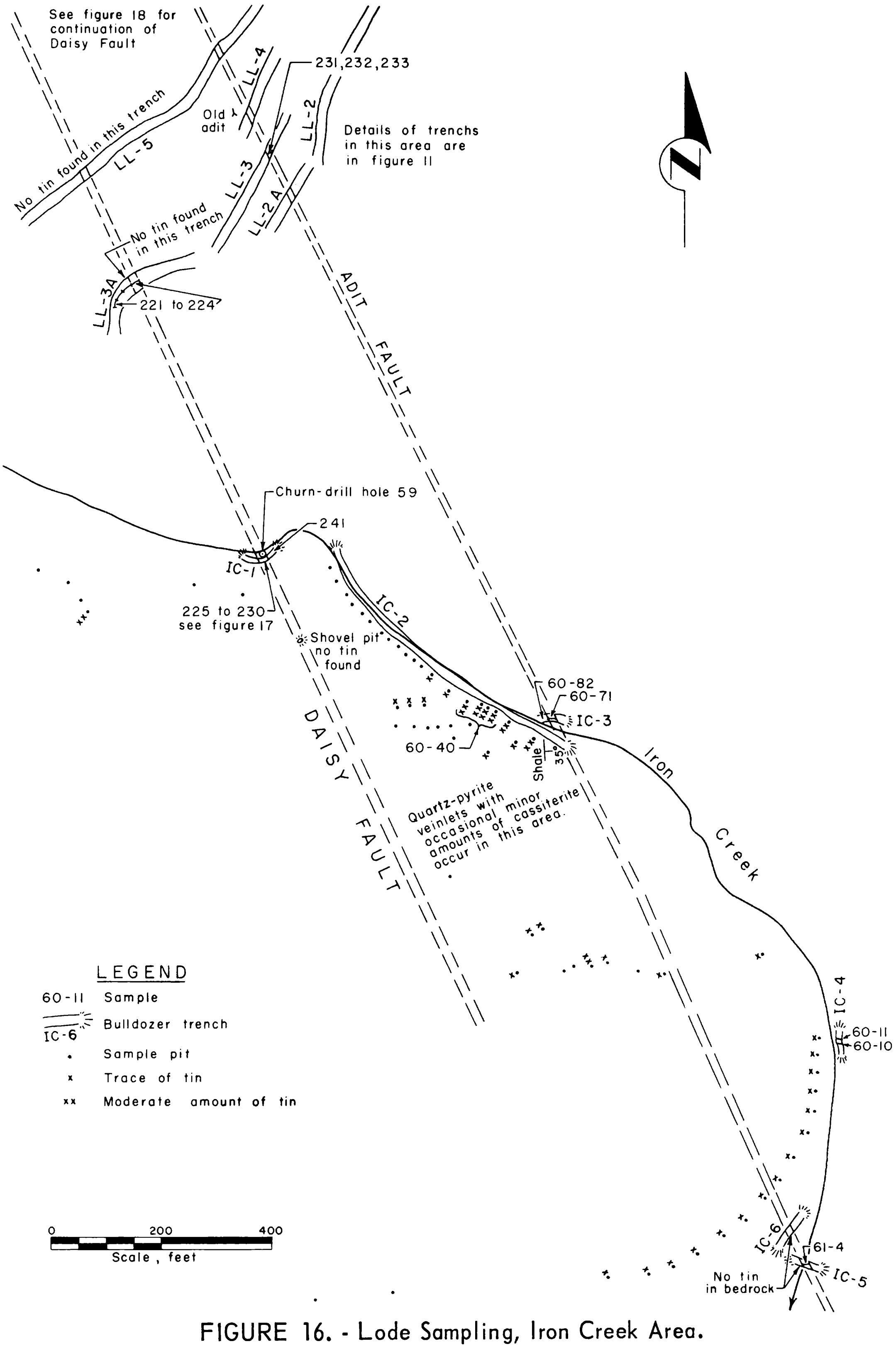


FIGURE 16. - Lode Sampling, Iron Creek Area.

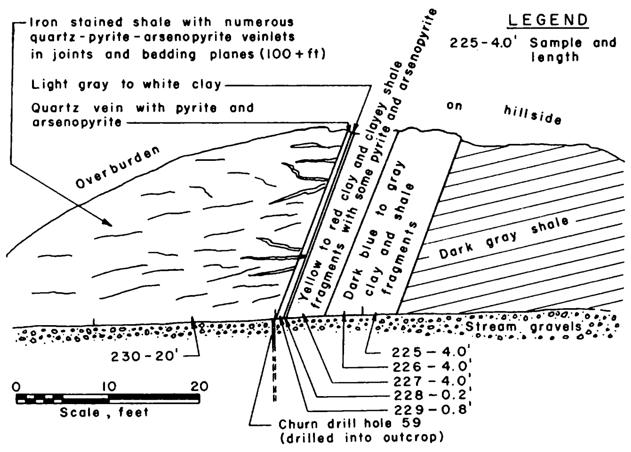


FIGURE 17. - Section Through Daisy Fault, Trench IC-1, Looking South.

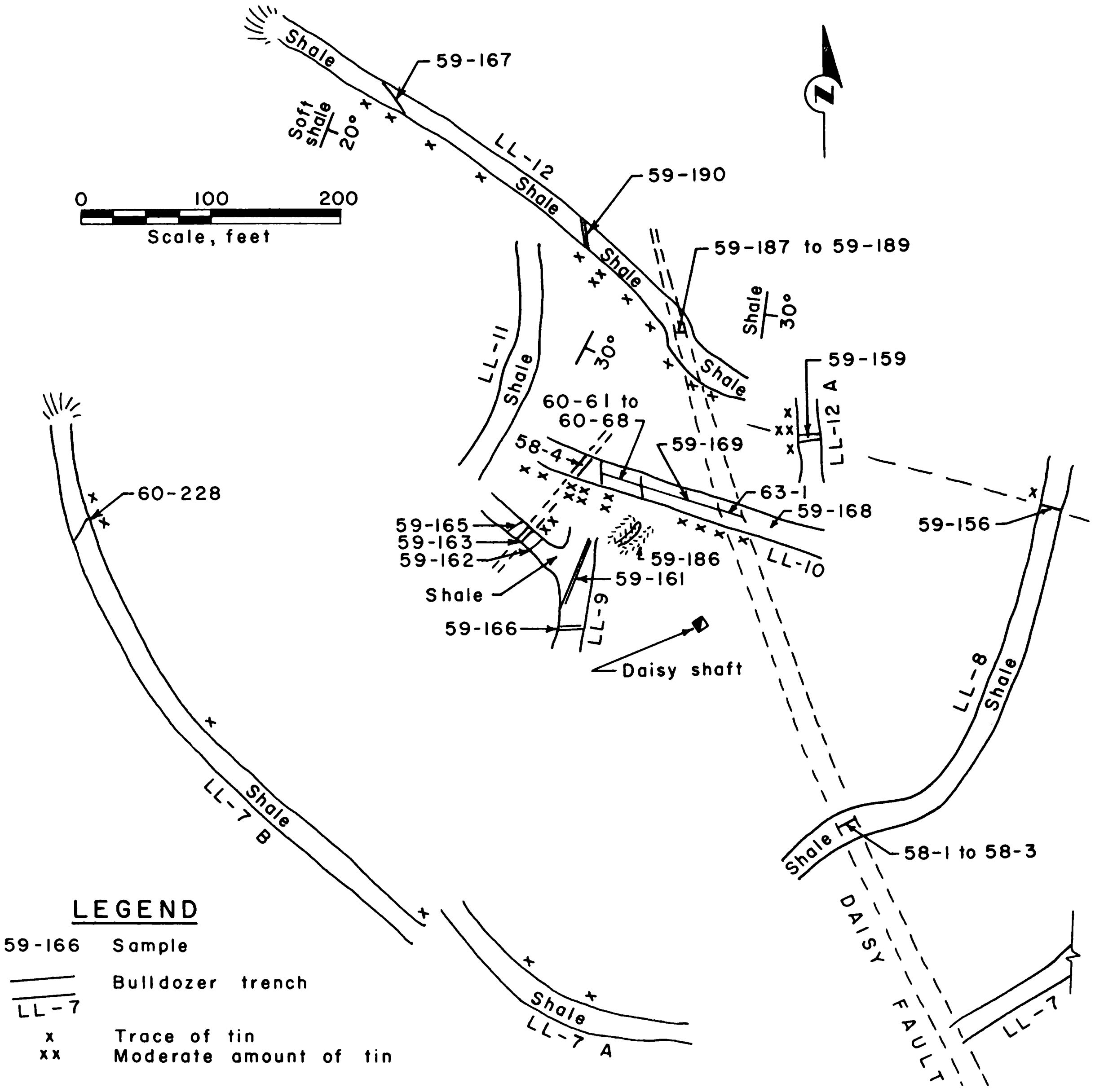


FIGURE 18. - Daisy Fault and Daisy Prospect, Summit of Little Potato Mountain.

pits on Iron Creek to trench LL-5 on the west side of South Gulch (fig. 11). Figure 17 is a cross section through the Daisy Fault where it crosses Iron Creek; it is typical of a number of similar occurrences in the Potato Mountain area. The Daisy Fault was traced to the summit of Little Potato Mountain where a cluster of low-grade quartz-clay-cassiterite veinlets (Daisy prospect) was found along the western side of the fault (fig. 3). Sample locations in trenches LL-7 through LL-12 at the Daisy prospect are on figure 18. Analyses data are in tables 20, 21, and 22.

TABLE 20. - Description and analyses of trench samples, Daisy Fault, Iron Creek drainage basin

Description			Analyses		
Sample					
Number	Length, feet	Character of material	Tin, percent	Spec.[1]	Petro.[2]
Trench IC-1					
225	4	Clay and shale (fig. 17)	0.06	-	-
226	4	do	.06	X	-
227	4	Clay and clayey shale (fig. 17)	.09	X	-
228	.2	White clay (fig. 17)	.06	X	-
229	.8	Quartz vein (fig. 17)	.06	X	-
230	20	Quartz veinlets in shale (fig. 17)	.06	X	-
241	-	Specimens; quartz-arsenopyrite-pyrite veinlets in shale.[3]	.43	-	-
CD-59	-	Bedrock churn-drill hole 59 (table 19 and fig. 16).[4]	<.03	X	-
Trench LL-3A					
221	10	Shale with quartz veinlets	<0.05	-	-
222	18	Iron-stained shale with quartz veinlets	<.05	-	-
223	20	Iron-stained shale with clay and quartz veinlets.	<.05	-	-
224	16	Clay and crushed shale	<.05	-	-
Trench LL-7B					
60-228	0.5	Quartz veinlet	0.04	-	-
Trench LL-8					
58-1	6	Crushed-shale fault filling	<0.05	-	-
58-2	4	do	<.05	-	-
58-3	6	do	<.05	-	-
59-156	1	Crushed shale and clay veinlet	.02	-	-
Trench LL-9					
59-161	1	Clay, pyrite, and quartz	0.07	X	X
59-162	1	Clay and quartz	.02	X	X
59-163	3	do	.08	X	X
59-165	.1	Quartz-pyrite veinlet	.03	-	-
59-166	1	Clay and quartz	.06	-	-
Trench LL-10					
63-1	15	Crushed-shale fault filling	<0.05	-	-
59-168	30	Specimen; east wall of crushed zone	<.01	-	X
59-169	63	Specimen; west wall of crushed zone	<.01	-	X
60-61	4	Quartz veinlets and lenses with clay in shale.	.04	-	-
60-62	4	do	.44	-	-
60-63	4	do	.07	-	-
60-64	4	do	.04	-	-
60-65	4	do	.03	-	-

See footnotes at end of table.

TABLE 20. - Description and analyses of trench samples, Daisy Fault Iron Creek drainage basin--continued

Description			Analyses		
Sample		Character of material	Tin, percent	Spec.[1]	Petro.[2]
Number	Length, feet				
60-66	4	Quartz veinlets and lenses with clay in shale.	0.12	-	-
60-67	4	do.................................	.16	X	-
60-68	4	do.................................	.07	-	-
Total or average	32		.12	-	-
58-4	2	Clay-filled fault or joint..................	.08	-	-
		Trench LL-12			
59-167	1	Quartz veinlet............................	<0.02	-	X
59-187	2	Crushed-shale fault filling................	.03	-	-
59-188	2	do.................................	.10	-	-
59-189	2	do.................................	.02	-	-
59-190	2	Clay, quartz, and altered shale............	<.01	-	-
		Trench LL-12A			
59-159	1	Quartz and clay veinlet....................	0.11	-	X
		Other areas			
60-45	-	Prospect pit 670 feet N 60° W of Daisy shaft	0.03	-	-
60-59	-	Specimens from Daisy prospect pit..........	.03	-	X
59-186	-	Dump of prospect pit near Daisy shaft......	.03	-	-

[1] See section entitled "Spectrographic Analyses."

[2] See section entitled "Petrography."

[3] Occasional large crystals of cassiterite were noted that appeared to have been derived from these veinlets, but sample 241 was composed of very fine vein quartz, pyrite, and limonite with no visible cassiterite.

[4] Equivalent uranium by Geiger counter = 0.003 percent.

TABLE 21. - Description and analyses of trench samples, Adit Fault, Iron Creek drainage basin

Description			Analyses		
Sample		Character of material	Tin, percent	Spec.[1]	Petro.[2]
Number	Length, feet				
		Trench IC-5			
61-4	13.5	Clay and crushed-shale fault filling........	<0.01	-	-
		Trench IC-3			
60-71	12	Clay and crushed-shale fault filling........	0.02	-	-
60-82	-	Pan concentrate from west side Adit Fault...	.02	-	X
		Trench LL-3			
231	2	Quartz and clay............................	<0.03	X	-
232	2	Clay and clayey-shale fragments[3]...........	.06	X	-
233	3	Clay and shale.............................	.06	-	-
		Other areas			
60-78	-	Adit dump..................................	0.01	-	-

[1] See section entitled "Spectrographic Analyses."

[2] See section entitled "Petrography."

[3] Note that the Adit Fault samples also are included in analyses data from trenches on the west side of South Gulch (fig. 11 and table 10).

TABLE 22. - Miscellaneous trench samples, Iron Creek drainage basin

Description			Analyses		
Sample		Character of material	Tin, per-cent	Spec.[1]	Petro.[2]
Number	Length, feet				
Trench IC-2					
60-40	-	Pan concentrate from right limit bank Iron Creek.	5.89	-	-
Trench IC-4					
60-10	0.5	Quartz vein, strike N 80° E, dip vertical, width 0.3 feet.	0.03	X	-
60-11	.5	Quartz vein, strike N 80° E, dip vertical, width 0.5 feet.	.02	X	-

[1] See section entitled "Spectrographic Analyses."
[2] See section entitled "Petrography."

Upper Buck Creek Drainage Basin

Placer Sampling, Upper Buck Creek

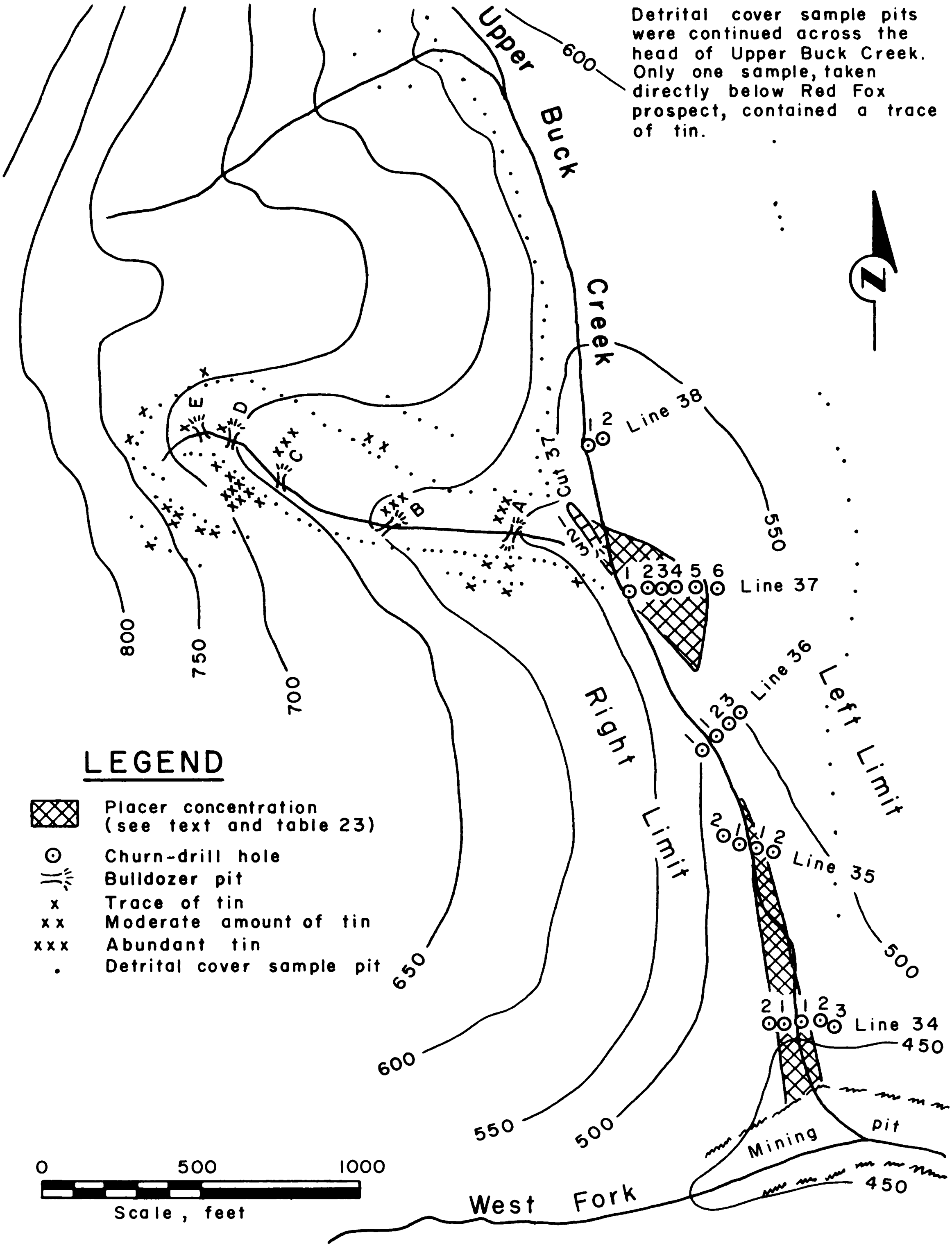
The results of the Bureau of Mines 1943 churn drilling on Upper Buck Creek indicated that a pay streak extended from the mouth of West Fork upstream to the mouth of the first right limit tributary above West Fork (fig. 19 and table 23). Only minor amounts of tin were found in drill-hole line 38 above the mouth of this tributary. The configuration of the placer deposit suggested a deltalike deposit at the mouth of this right limit tributary (drill-hole line 37, fig. 19).

Five sample pits were excavated by bulldozer in the placer gravels of the first right limit tributary above West Fork. Substantial quantities of tin were found in pits A, B, and C. Only traces of tin were found in pits D and E. The relatively uniform amounts of tin in pits A, B, and C, and the abrupt decrease in grade between trenches C and D suggested that the principal source of tin was near pit C or between pits C and D.

Detrital Cover Sampling, Upper Buck Creek

Results of detrital cover sampling (fig. 19) tended to confirm deductions that the principal lode source was between placer pits C and D on the first right limit tributary above West Fork although some tin was derived from the headwaters of this tributary. A second row of sample pits on the right limit indicated a decrease in the grade. A few pans taken further uphill indicated that decreasingly small traces of tin extended a few hundred feet above the second row of pits. The amount of cassiterite above the second row of pits appeared to be too small to warrant additional sampling. Traces of cassiterite also were found in a few pits on the right limit bank near pit A.

Detrital cover sampling was continued to the headwaters of Upper Buck Creek because of the old prospects in this area. Results were negative except for a scant trace of tin found below the Red Fox prospect at the extreme head of the valley.



Detrital cover sample pits were continued across the head of Upper Buck Creek. Only one sample, taken directly below Red Fox prospect, contained a trace of tin.

FIGURE 19. - Placer and Detrital Cover Sampling, Upper Buck Creek.

TABLE 23. - Churn-drilling and trench-sampling results, 1943, Upper Buck Creek[1]

Line and hole	Mining section, feet	Tin, lb per cu yd	Abundance factor[2]
Line 34:			
3 (LL)	3.0	0.26	78
2 (LL)	3.5	.69	241
1 (LL)	3.5	1.65	578
1 (RL)	4.0	2.92	1,168
2 (RL)	3.0	.05	15
Line 35:			
2 (LL)	3.5	.63	221
1 (LL)	4.5	1.89	850
1 (RL)	3.5	1.00	350
2 (RL)	2.0	.20	40
Line 36:			
3 (LL)	5.0	.21	105
2 (LL)	7.5	.41	308
1 (LL)	2.0	.63	126
1 (RL)	1.5	.28	42
Line 37:			
6	6.0	.36	216
5	7.0	1.79	1,253
4	5.0	1.67	835
3	4.0	1.46	584
2	3.0	1.30	390
1	4.0	1.64	656
Line 38:			
2	5.0	.19	95
1	0	0	0
Cut 37:			
Samples:			
1	1.7	1.46	248
2	2.5	6.21	1,553
3	3.6	.37	133

[1] Summary of data from Bureau of Mines Report of Investigations 4418 (30).

[2] (Mining section, feet) x (tin, lb per cu yd) x 100 = abundance factor. See section of this report entitled "Placer Sampling and Evaluation."

Lode Sampling, Upper Buck Creek

Nine bulldozer trenches were started where detrital cover sampling indicated the presence of tin (fig. 20). Three were continued to bedrock; trenches BC-3, BC-5, and BC-8. The others were abandoned when panning indicated that little or no tin was present. Panning results are indicated in figure 20. The three trenches continued to bedrock exposed a cluster of quartz veinlets in shales adjacent to a fault filled with clay and crushed

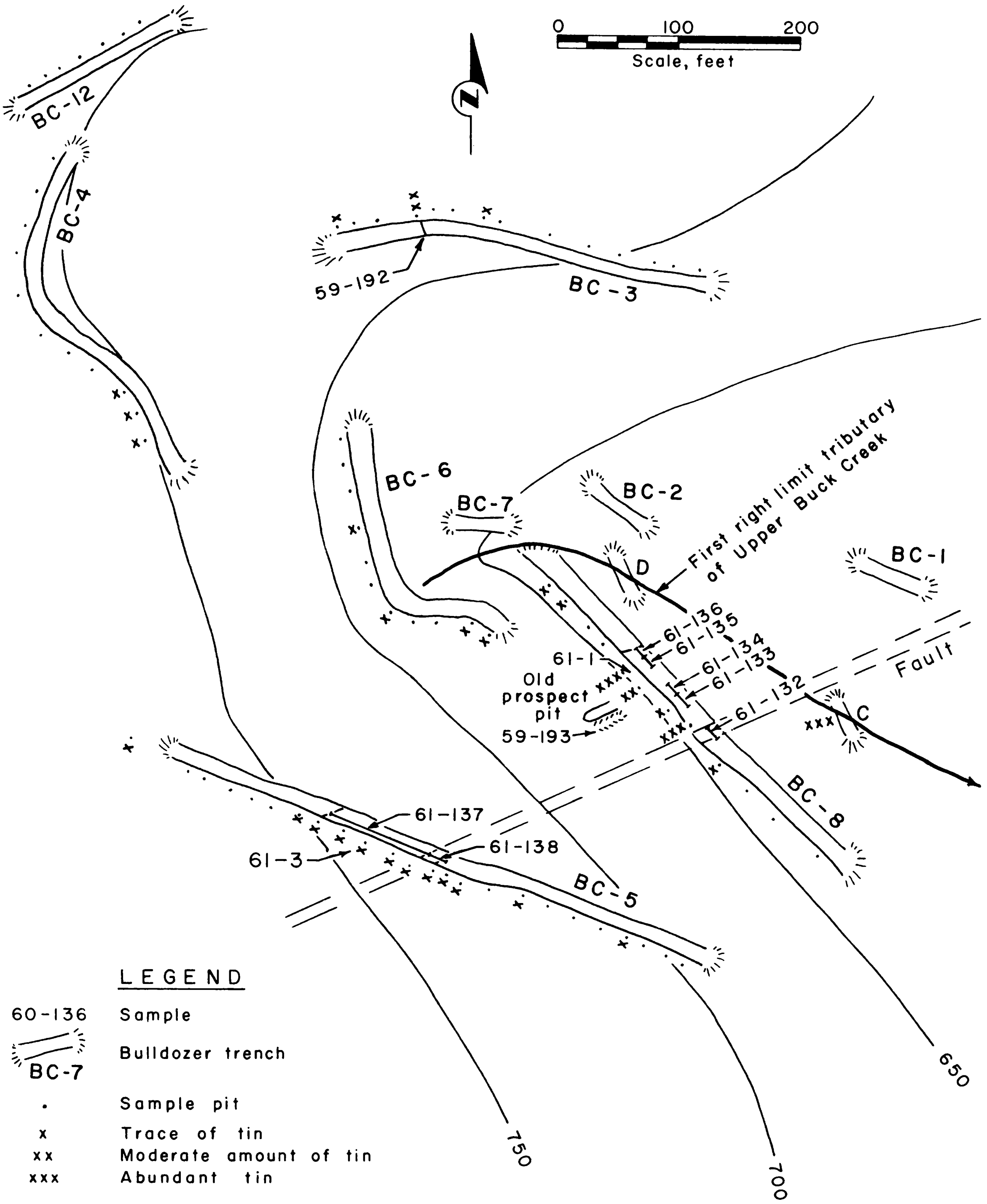


FIGURE 20. - Lode Sampling, Upper Buck Creek.

shale (fig. 20 and table 24). Although individual quartz veinlets were found that contained 2 percent or more tin, the overall grade of the deposit does not exceed 0.10 percent tin.

TABLE 24. - Description and analyses of trench samples, Upper Buck Creek drainage basin

Description			Analyses		
Sample					
Number	Length, feet	Character of material	Tin, percent	Spec.[1]	Petro.[2]
		Trench BC-8			
61-1	-	Selected specimens, quartz veinlets...	2.32	-	X
61-132	8	Crushed zone in fault, chip samples...	.04	-	-
No sample	24	Iron-stained shale with few quartz veinlets, chip samples.	-	-	-
61-133	10	Quartz-pyrite veinlets in shale, chip samples.	.05	-	-
61-134	10	do............................	.13	-	-
No sample	21	Iron-stained gray shale, chip samples.	-	-	-
61-135	7	Quartz lenses in gray shale, chip samples.	.01	-	-
61-136	7	do............................	.01	-	-
Total or average	87		.03	-	-
		Trench BC-5			
61-3	-	Selected specimens, quartz veinlets...	0.03	-	-
61-137	80	Occasional quartz-clay veinlets in shale, chip samples.	.01	-	-
61-138	5	do............................	.01	-	-
		Trench BC-3			
59-192	-	Specimens of 1 to 3 inch quartz veinlets.	0.04	-	X
		Other areas			
59-193	-	Specimens from prospect pit between trenches BC-5 and BC-8.	0.08	X	X

[1] See section entitled "Spectrographic Analyses."

[2] See section entitled "Petrography."

Miscellaneous Prospects

The various lode tin prospects in the Potato Mountain area were examined during the investigation. Routine examinations included sampling the outcroppings, if exposed, the dumps, and the detrital cover downhill from the prospect. A description of the Daisy lode prospect is included with the data on lode deposits in the Iron Creek area. An adit on the east slopes of Little Potato Mountain is included in the area sampled at the head of West Fork. The more prominent of the remaining prospects are described in the sections that follow. Numerous other pits were examined, but no tin or only scant traces were found.

Drusy Quartz Vein and Andesite Dike

A notable feature of the Buck Creek area is a prominent quartz vein averaging about 12 feet wide, that was traced at least 8,000 feet from the Left

Fork-Buck Creek intersection northward to the valley of Red Fox Creek (fig. 3). Probably this vein extends farther on one or both ends. The vein pinches and swells, and lesser veins and veinlets extend irregularly into the shale walls. In some sections, the vein and the accompanying veinlets form an extensive network up to 100 feet wide that encloses numerous shale horses and fragments. The smaller shale fragments serve as nuclei for radiating clusters of quartz crystals. Drusy cavities are common.

Northeast of the airfield (fig. 3) is an andesite dike (see sample 60-2, in the section of this report entitled "Petrography") about 3 feet wide, nearly vertical, and striking about N 25° W. The length was not determined.

Extensive panning along the outcrop of the drusy quartz vein and the andesite dike indicated that no tin occurs in either. The only heavy metallic mineral noted was an occasional trace of pyrite or limonite.

Mouth of West Fork

Placer miners who had mined on Buck Creek and West Fork reported that a tin-bearing vein crossed the bed of West Fork about 300 feet from the mouth. Abundant quartz veins and veinlets, some of which are iron stained, are exposed in the streambed in this area and downstream to the West Fork-Buck Creek intersection. Samples of these quartz veins contained occasional small amounts of pyrite or limonite, but no tin. Samples 60-1 and 60-6 are typical of the shale bedrock; sample 60-7 is a typical specimen of a vein cutting the bedrock (see section of this report entitled "Petrography"). The detrital cover on the banks of both Buck Creek and West Fork was sampled (fig. 21) with negative results. While investigating Upper Buck Creek, occasional traces of tin were found in the detrital cover 200 to 300 feet from the mouth of the first right limit tributary above West Fork (fig. 21). The tin could not be found in bedrock, but a crushed zone was found. By means of aerial photos, this crushed zone was traced to the general locality of the reported tin vein on West Fork. Trenches excavated on both sides of West Fork intersected crushed shaly material. No tin was found. It was concluded that, in the streambed, the soft crushed zone had served as an efficient nugget trap and hence resembled a lode outcropping.

Red Fox Prospect

The Red Fox prospect is at the head of Buck Creek on the summit of the divide that separates the Buck Creek drainage basin from the Red Fox drainage basin (figs. 3 and 22). The principal working is a 5- by 5-foot timbered and lagged shaft. The size of the dump suggests that the shaft is about 30 feet deep, if no drifts were driven. When examined, this shaft was filled with ice to within 8 feet of the surface. The workings also include four hand-dug trenches and a number of shallow pits. All workings are probably over 50 years old.

The detrital overburden and the dumps were sampled. The detrital overburden on both sides of the divide contained a scant trace of tin (fig. 22). Examination of the dumps revealed a small amount of rock with visible pyrite,

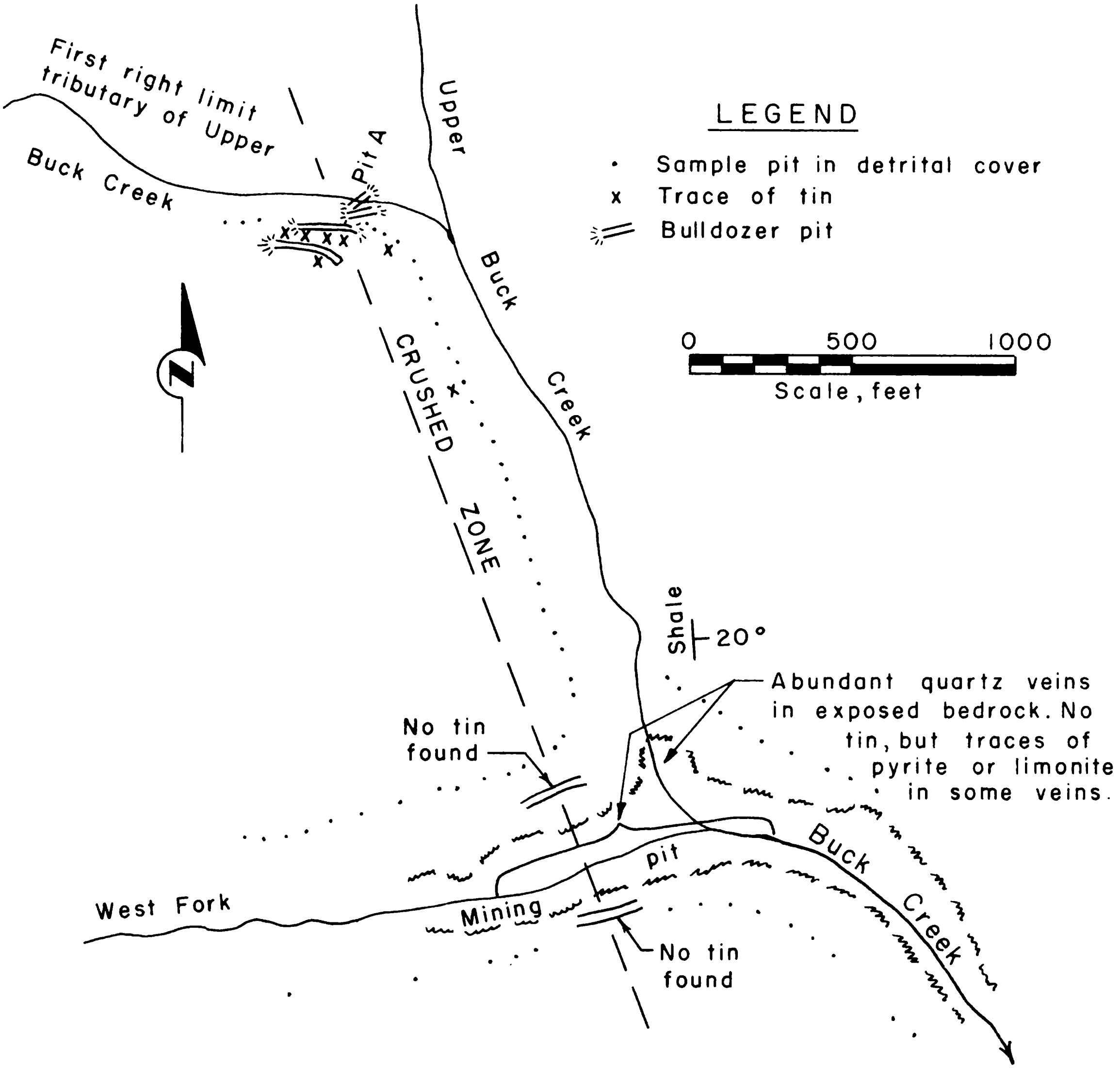


FIGURE 21. - Intersection of Buck Creek and West Fork.

but no visible cassiterite. Two specimens were selected from what appeared to be the highest grade material.

Sample descriptions and analyses data are in table 25.

TABLE 25. - Description and analyses of selected specimens, Red Fox prospect

Description			Analyses		
Sample		Character of material	Tin, percent	Spec.[1]	Petro.[2]
Number	Length, feet				
60-12	-	Selected specimens, western pit...	0.34	X	-
60-13	-	Selected specimens, shaft dump....	.07	X	-

[1] See section entitled "Spectrographic Analyses."

[2] See section entitled "Petrography."

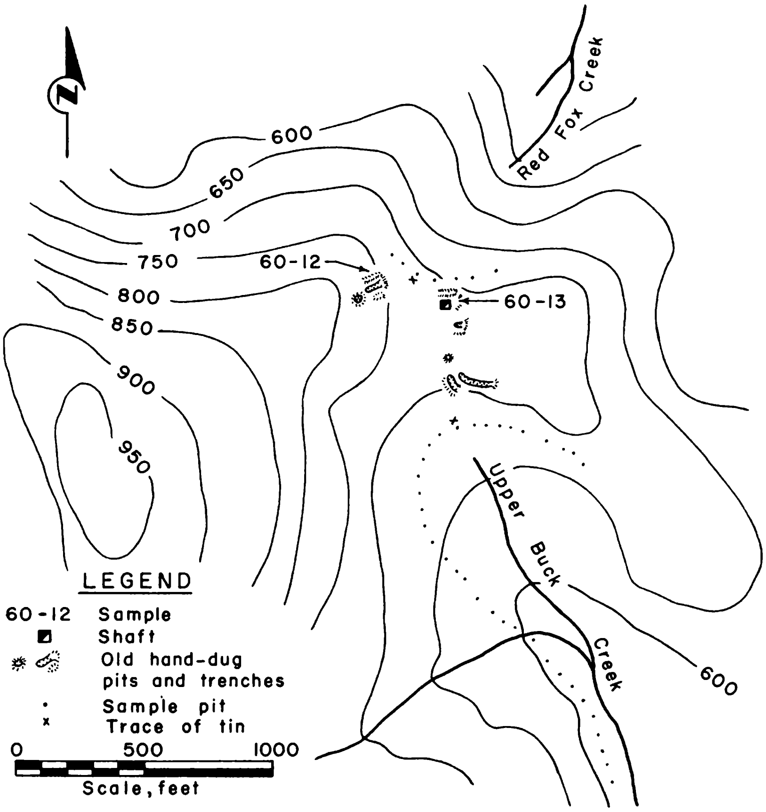


FIGURE 22. - Red Fox Prospect, Potato Mountain Area.

Quartz Porphyry Dike

A quartz porphyry dike on the divide between the west branch of Red Fox Creek and the first right limit tributary of Upper Buck Creek (figs. 3 and 23) had been prospected by several pits. The apex of the dike is exposed in a pit on the northeast side of the knoll that forms the south side of the divide; the shale can be seen arching over the apex. From this pit, the dike outcrop, or frost-broken fragments of the outcrop, can be traced to the northeast for almost 2,000 feet (fig. 23).

The following petrographic report describes a typical specimen of the hard, light-gray dike material:[5]

> The specimen (No. 244) is a metasomatic rock hydrothermally derived from an acidic igneous rock. Only euhedral Beta-quartz forms of quartz phenocrysts remain intact from changes produced by metasomatism. Pseudomorphs of original feldspars can be seen readily, but the feldspars and the groundmass have both been altered to hydromuscovite. An introduction of a myrmekitic-like intergrowth of pyrite probably accompanied the hydration of the feldspathic minerals. The pyrite does not replace the euhedral quartz grains but does penetrate the groundmass and large pseudomorphs without respect to chemical environment. Like myrmekitic quartz intergrowth, the numerous and fine penetrations are all one pyrite crystal; this is revealed by the presence of exactly parallel pyrite faces with parallel pyrite striations. No tin mineral was recognized. Chemical analyses indicated 0.04 percent of tin.

Frost-broken material on the outcrop of this dike was panned. No tin was found. Most of the area in which the dike occurs is drained by the western branch of Red Fox Creek. A panned sample of placer gravels from near the extreme head of this stream contained little more than traces of tin. A series of detrital cover samples taken from the hill slopes below the outcrop

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[5] Previously unpublished report by Walter Gnagy, petrographer, Area VIII Mineral Resource Office, Bureau of Mines, Juneau, Alaska.

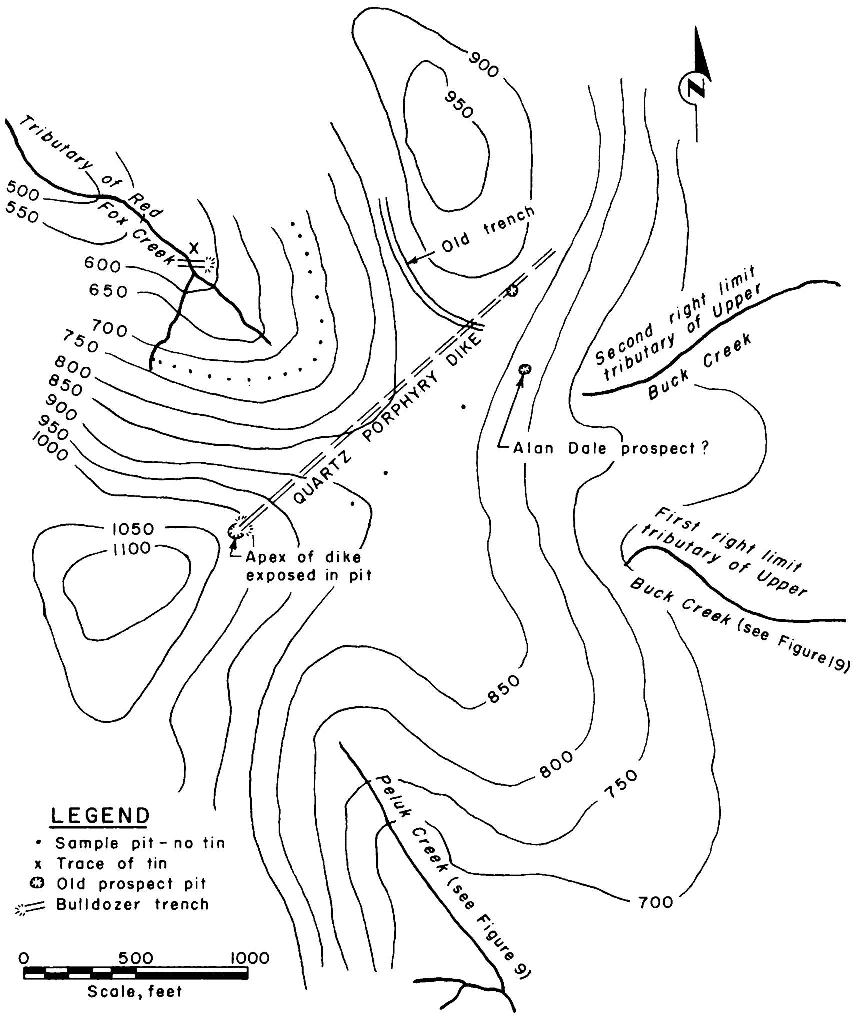

FIGURE 23. - Quartz Porphyry Dike and Alan Dale Prospect.

(fig. 23) contained no tin at all. Samples taken from the headwater tributaries of Peluk Creek contained no tin. The tin in Upper Buck Creek was found to have been derived from another source (see section on this drainage basin). Therefore, it seems apparent that neither this quartz porphyry dike nor the adjacent rocks contain significant deposits of tin.

Alan Dale Prospect

The Alan Dale prospect is thought to be located as shown in figure 23. The dump was examined and the detrital cover downslope from the pit was sampled. No more than a scant trace of tin was found.

Eureka Prospect

The Eureka prospect is on the northeast side of the summit of Little Potato Mountain 1,500 feet N 35° W of the Daisy lode (figs. 3 and 5). Workings include a shaft about 6 feet deep, a hand-dug trench, a sample pit, and a small rock-walled roofless shelter. The nature and distribution of quartz float visible on the surface would suggest that quartz veins and veinlets occur generally alined with bedding in shales that strike N 15° W and dip 20° to the east. The quartz float occurs in an area about 40 feet wide and about 300 feet long.

Specimens, selected from the dumps of the workings, were analyzed. Specimen descriptions and analyses results are in table 26. No additional work was done at this prospect.

TABLE 26. - Description and analyses of specimens, Eureka prospect, Little Potato Mountain

Description			Tin, analyses percent
Sample		Character of material	
Number	Length, feet		
6-17-1	-	Specimens of quartz float.......	<0.01
6-17-2	-	Dump specimens, hand-dug trench.	.04
6-17-3	-	Dump specimens, shaft..........	.23

Oakland Creek-West Fork Divide

A body of frost broken massive dominantly quartz rock and a large number of quartz veins occur in the Oakland Creek-West Fork divide. These have been explored by several very old prospect pits including a hand-dug trench about 40 feet long and a sample pit (figs. 3 and 5) dug in the mass of quartz rock near the center of the divide. A number of smaller pits explore less prominent quartz outcroppings on the north side of the divide.

The detrital cover was sampled on both the Oakland Creek side and the West Fork side of the divide (fig. 10). No recognizable tin mineral was recovered. Samples also were taken from the gravels at the head of Oakland Creek and West Gulch, the headwater tributary of West Fork. Only barely recognizable traces of cassiterite were found. Selected specimens for laboratory analyses were taken from the dump of the trench and the sample pit because of the relatively large amount of massive quartz present. Specimen descriptions and analyses are in table 27. No tin mineral was recognized, either in the field or in the laboratory, but chemical analyses indicated the presence of somewhat less than 0.1 percent of tin, apparently associated with tourmaline and quartz.

TABLE 27. - Description and analyses of specimens, Oakland Creek-West Fork divide

Description			Analyses		
Sample		Character of material	Tin per-cent	Spec.[1]	Petro.[2]
Number	Length, feet				
60-58	-	Assorted specimens of the trench dump..	-	-	X
219	-	do...............................	0.09	-	-
59-191	-	Assorted specimens of the prospect dump	.03	X	-

[1] See section entitled "Spectrographic Analyses."

[2] See section entitled "Petrography."

Iron Creek-Oakland Creek Divide

The only evidence of lode prospecting in the Iron Creek-Oakland Creek divide is a small pit on a quartz outcropping about 200 feet east of the center of the divide (figs. 3 and 15). Selected specimens from this dump were analyzed chemically and found to contain 0.05 percent tin; but the tin mineral could not be identified. Detrital cover samples across the head of Iron

Creek (fig. 15) indicated that the only tin in the area was a scant trace of cassiterite derived from the vicinity of this prospect pit. Panned stream concentrates taken from the extreme headwaters of both Iron Creek and Oakland Creek indicated only traces of cassiterite in the gravels.

Summit of Big Potato Mountain

A series of small shovel pits and trenches at intervals of 200 to 400 feet in a line roughly N 10° W extend across the summit of Big Potato Mountain (fig. 3) and about 1,000 feet down the southern slope. The pits explore a thin line of quartz-pyrite and limonite fragments in soft earthy to shaly debris. The quartz and associated minerals appear to be the surface expression of a deposit alined along the contact between an overlying hard blocky schist and a softer shale. Examination of the material on the surface failed to yield any recognizable tin minerals. A suite of selected specimens from the pit dumps were analyzed chemically and found to contain 0.05 percent tin. A typical specimen (sample 61-8) was analyzed petrographically (see the section entitled "Petrography"). The placer examinations and detrital cover sampling along Iron Creek (fig. 15) indicated that only traces of tin were derived from the upper slopes of Big Potato Mountain.

Associated Minerals

Copper, Lead, and Zinc

Widespread traces of copper and lead that can be detected by spectrographic or chemical analyses occur in the Potato Mountain area but no deposits were recognized in the field. The widespread occurrence would suggest that copper and lead sulfides may be minor components of the widespread pyrite and arsenopyrite deposits. Zinc was detected in a few samples by spectrographic or spectroscopic analyses but apparently it is less abundant than copper or lead.

Radioactive Minerals

No radioactive minerals were identified in the Potato Mountain area. Routine checks were made with a laboratory Geiger counter on several hundred samples and specimens of the various rocks in the area. Results generally were negative although in a few cases traces were indicated. The samples checked included the churn-drill concentrates from West Fork and Iron Creek; most were negative but a few indicated an equivalent uranium content of 0.001 percent. In bedrock samples traces of radioactivity occasionally were found in zones containing quartz-pyrite veins and clay minerals. The greatest amount of radioactivity observed in such zones indicated 0.003 percent equivalent uranium; the radioactive mineral or rock could not be isolated. No radioactivity was detected in specimens of the various igneous dikes. Because the results were negative except as mentioned above, data on the analyses for radioactive minerals have not been tabulated.

Fluorite

No fluorite was recognized in the field but a small amount was found during the petrographic analyses of a sample (sample 60-59, table 20) from the Daisy prospect on the summit of Little Potato Mountain. Fluorite is a common accessory mineral in the Seward Peninsula tin deposits; therefore, the scarcity of fluorite and fluorine minerals in the Potato Mountain area was considered remarkable. As a partial check, semiconcentrates from churn-drill holes 41 through 63 (tables 9 and 19) were analyzed spectroscopically. The method used would detect as little as 0.2 percent CaF_2, but none was found. As an additional check, a number of samples were mixed to form a composite sample typical of the quartz-clay-pyrite-cassiterite deposits. Analyses of the composite sample indicated 0.2 percent CaF_2. Apparently minor amounts of fluorite or other fluorine minerals occur associated with the quartz-clay-cassiterite deposits.

Beryllium

The investigation did not include a geochemical or other specific reconnaissance for beryllium minerals. The sampling program was designed to delimit tin deposits. As a matter of routine, 23 representative specimens and samples were analyzed spectrographically (see the section entitled "Spectrographic Analyses"). Every sample contained beryllium but the amounts ranged downward from 0.01 percent (100 parts per million) to the minimum detectable. The beryllium mineral could not be isolated or identified. Forty-five additional specimens and samples representing the placer gravels and the principal rock types on the eastern slopes of Potato Mountain were scanned with a berylometer. Results were negative. However, the minimum amount of beryllium detectable with this instrument certainly was over 100 parts per million and probably was about 200 parts per million, well above the maximum amount indicated by spectrographic analyses.

Obviously the scarcity or lack of beryllium in these samples does not eliminate the possibility that valuable beryllium concentrations may occur in the area. However, deposits of beryllium that were found in the nearby Lost River area occur associated with fluorite in a thick series of metalimestones. At Potato Mountain calcereous shales and shaly limestones occur in the black-slate series but neither massive metalimestones nor abundant fluorite are known.

Gold

Only an occasional flake of gold was found while sampling the tin placers, and no gold at all was found during the detrital cover and lode sampling programs. However, the placer tin mining operations on Buck Creek consistently recovered some gold. There is no exact data on the amount of gravel mined, the efficiency of the gold recovery equipment, or the total amount of gold recovered. During one 4-year period of operation about 200 tons of tin and 270 ounces of gold were recovered from an estimated 300,000 cubic yards of gravel. At $35.00 per troy ounce gold recovered from the gravel had an average value of 3 cents per cubic yard. The occurrence of placer gold appears to have no relationship to the occurrence of placer tin. Roughly similar amounts of gold have been found in many streams draining the black-slate areas.

Spectrographic Analyses

Semiquantitative spectrographic analyses data are in table 28. The sample number, the sample location, and the number of the table in which the sample is described appear in the boxheads above analyses data.

TABLE 28. - Spectrographic analyses

Letters indicate estimates from qualitative analyses:

A Over 10 percent
B 5 to 10 percent
* Sn interference
C 1 to 5 percent
D 0.1 to 1 percent
E 0.01 to 0.1 percent
F 0.001 to 0.01 percent
G Under 0.001 percent
- Not detected

Sample[1]	Composite 59-137-139	Composite 59-124-126	Composite 61-128-131	59-94	Composite 59-71-72	Composite 60-150-155, 61-110-116	Composite 60-165-170	Composite 59-45-51	61-49	Composite 59-26-29	59-195
Trench, location[2]	TR-LL-5	TR-LL-4	TR-LL-2	TR-RL-1	TR-RL-2	TR-RL-2A	TR-RL-2B	TR-RL-3	TR-RL-14	TR-RL-4	TR-RL-5
Table[3]	10	10	10	11	11	11	11	11	11	11	11
Aluminum	A	A	A	B	A	C	C	A	C	A	C
Arsenic	-	-	C	D	D	D	D	-	-	D	-
Barium	-	-	-	-	-	E	E	-	E	-	-
Beryllium	F	G	G	F	F	F	F	G	G	G	G
Bismuth	F	E	E	E	E	F	F	-	-	-	-
Boron	C	C	C	C	B	D	C	C	C	D	D
Cadmium	E	E	E	E	E	-	-	-	-	E	-
Calcium	C	C	C	D	C	C	C	B	D	A	C
Chromium	E	E	E	F	F	E	E	F	E	F	E
Cobalt	E	-	F	-	-	F	F	-	F	-	E
Copper	F	F	F	F	F	F	F	F	F	F	F
Gallium	-	-	-	E	E	-	-	E	-	E	-
Iron	A	A	A	A	A	C	C	A	A	A	A
Lead	E	E	D	E	D	E	E	-	-	E	-
Lithium	E	-	E	-	-	D	-	-	-	-	-
Magnesium	B	B	B	C	B	C	C	B	C	B	C
Manganese	D	D	D	E	E	E	E	E	E	E	E
Molybdenum	E	E	E	-	F	-	-	F	F	-	E
Nickel	E	E	E	F	E	E	E	E	E	E	E
Phosphorus	-	-	-	-	-	-	-	-	-	-	-
Scandium	-	-	-	-	-	-	-	-	F	-	F
Silicon	A	A	A	A	A	A	A	A	A	A	A
Silver	G	F	G	G	F	-	-	G	-	G	-
Sodium	C	D	D	D	C	D	D	C	C	D	D
Tin	C	C	C	A	C	E	E	C	C	D	D
Titanium	C	C	C	D	C	D	D	C	C	C	C
Vanadium	E	E	E	E	E	D	D	E	E	E	E
Yttrium	-	-	-	-	-	-	-	-	-	-	-
Zinc[4]	-	-	-	-	-	-	-	-	-	-	-
Zirconium	F	F	F	F	F	E	E	F	E	F	E

[1] Sample numbers are inclusive; that is, 59-137-139 covers 59-137, 59-138, and 59-139, and so on.

[2] Trench, drill hole, or other sample site.

[3] Table in which sample is described.

[4] Cadmium occurring in the absence of zinc was considered anomalous. Therefore cadmium-bearing samples were reanalyzed spectroscopically. Less than 0.001 percent cadmium was indicated and occasional traces of zinc were found.

TABLE 28. - Spectrographic analyses--continued

Letters indicate estimates from qualitative analyses:

A Over 10 percent
B 5 to 10 percent
* Sn interference
C 1 to 5 percent
D 0.1 to 1 percent
E 0.01 to 0.1 percent
F 0.001 to 0.01 percent
G Under 0.001 percent
\- Not detected

Sample[1]..........	61-81	59-203	60-30	Composite 226-230	CD-59	60-67	Composite 59-161-163	Composite 231-232	Composite 60-10-11	59-193	Composite 60-12-13	59-191
Trench, location[2]	TR-RL-5	TR-RL-5A	TR-Peluk-5	TR-IC-1	TR-IC-1	TR-LL-10	TR-LL-9	TR-LL-3	TR-IC-4	TR-BC-5	Red Fox	OC-WF Div.
Table[3]...........	11	11	17	20	20	20	20	21	22	24	25	27
Aluminum.........	A	C	C	A	A	C	A	A	B	C	C	C
Arsenic..........	C	-	B	D	-	D	D	-	-	D	D	D
Barium...........	-	-	-	E	-	E	-	E	-	E	-	-
Beryllium........	G	G	G	F	G	G	G	G	G	G	G	G
Bismuth..........	F	-	F	-	-	-	-	-	-	-	-	-
Boron............	-	C	*	D	C	C	C	C	C	C	C	C
Cadmium..........	-	-	-	-	-	-	E	-	-	-	E	-
Calcium..........	D	D	E	C	B	D	C	D	C	E	C	D
Chromium.........	E	E	E	E	E	E	E	E	F	E	F	E
Cobalt...........	F	F	E	E	E	F	F	F	E	F	E	F
Copper...........	F	F	E	F	F	F	F	F	F	F	F	F
Gallium..........	-	-	-	-	-	-	-	-	E	-	E	-
Iron.............	B	A	A	A	A	A	A	A	A	A	A	A
Lead.............	E	-	E	E	E	-	-	-	-	E	E	E
Lithium..........	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium........	C	C	C	C	C	C	B	C	C	C	C	C
Manganese........	E	E	E	D	D	E	D	D	E	E	E	E
Molybdenum.......	F	F	-	F	E	F	E	F	-	E	-	E
Nickel...........	E	E	E	E	E	E	E	E	E	E	E	E
Phosphorus.......	-	-	-	-	-	-	-	-	-	-	-	-
Scandium.........	-	F	-	-	-	F	-	-	F	F	-	F
Silicon..........	A	A	A	A	A	A	A	A	A	A	A	A
Silver...........	-	-	G	-	-	-	G	-	G	-	F	-
Sodium...........	D	C	E	-	D	C	C	C	C	D	D	D
Tin..............	A	C	A	E	-	D	D	E	E	D	D	D
Titanium.........	C	C	E	C	C	C	C	C	D	C	D	C
Vanadium.........	E	E	E	E	D	E	E	D	E	E	E	E
Yttrium..........	-	-	-	-	-	-	-	-	F	-	-	-
Zinc[4]............	-	-	E	-	-	-	-	-	-	-	-	-
Zirconium........	F	E	E	E	E	E	F	E	E	E	E	E

[1] Sample numbers are inclusive; that is, 59-137-139 covers 59-137, 59-138, and 59-139, and so on.

[2] Trench, drill hole, or other sample site.

[3] Table in which sample is described.

[4] Cadmium occurring in the absence of zinc was considered anomalous. Therefore cadmium-bearing samples were reanalyzed spectroscopically. Less than 0.001 percent cadmium was indicated and occasional traces of zinc were found.

Petrography

by

Walter L. Gnagy[6]

Identifications

Identifications of rocks and component minerals are in table 29. Sample descriptions and other analytical data are in the tables listed at the head of each column below the sample number and location. The relatively limited assemblage of minerals present in the Potato Mountain area contrasts markedly with the varied assemblage of minerals associated with the tin deposits in the nearby Brooks Mountain-Lost River area.

Supplemental Notes on Selected Specimens

Sample 61-75. - Sample 61-75 (table 11, trench RL-18) is a fine-grained tourmaline schist that includes thin lenticular veins and has been cut by fissure veins and replacement veins. The lenticular veins are up to 1 mm in width and 20 mm in length; they contain arsenopyrite and have been subjected to irregular differential deformation along with the tourmaline schist. The fissure veins range in width from 0.2 mm to 20 mm and contain cassiterite associated with arsenopyrite, pyrite, and quartz. The replacement veins have replaced much of the tourmaline schist through solution; they are irregular in shape and composed primarily of quartz with rotated tourmaline schist fragments, calcite, and coarse crystals and aggregates of pyrite. The individual replacement veins have a maximum width of 50 mm but occur in a brecciated zone that exceeds 10 cm in width.

Arsenopyrite occurs in four environments: (1) In small veinlets of arsenopyrite, cassiterite, and quartz; (2) in larger fissure veins as coarse aggregates adjacent to the tourmaline schist; (3) in replacement (metasomatic) veins with coarse cassiterite crystals that make up discontinuous coarse aggregates along tourmaline schist borders; and (4) in thin veinlike lenses in tourmaline schist that have been subjected to irregular differential deformation along with the tourmaline schist.

Pyrite occurs in four environments: (1) In thin (0.1-mm) veins filling fractures; (2) in thin borders on some fissure cassiterite veins; (3) along some borders between tourmaline schist and replacement (metasomatic) quartz veins; and (4) as large (20-mm) pyrite aggregates in metasomatic quartz veins.

Quartz occurs in two environments: (1) With cassiterite in fissure-type veins; and (2) with coarse pyrite in replacement (metasomatic) quartz veins.

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[6] Petrographer, Area VIII Mineral Resource Office, Bureau of Mines, Juneau, Alaska.

TABLE 29. - Petrographic identifications

P - Predominant...... Over 50 percent
A - Abundant......... 10 - 50 percent
S - Subordinate...... 2 - 10 percent
M - Minor........... 0.5 - 2 percent
F - Few............ 0.1 - 0.5 percent
T - Trace...... Less than 0.1 percent

X - Detected in sample
N - Sought but not detected
C - Rock classification

Sample[1]..............	60-197	61-75	60-135	60-134	61-2	60-140	60-141A	60-141B
Trench, location.....	LL-1	RL-18	RL-5	RL-5	RL-19	RL-6	RL-6	RL-6
Table[1]..............	10	11	11	11	11	11	11	11
Rocks:								
Andesite...........	-	-	-	-	-	-	-	-
Breccia............	-	-	-	-	-	-	-	-
Clay...............	-	-	-	-	-	-	-	-
Gossan.............	-	-	-	-	-	-	-	-
Phyllite...........	C	-	C	C	-	C	-	-
Quartzite..........	-	-	-	-	-	-	-	-
Schist.............	-	C	-	-	-	-	-	-
Shale..............	-	-	-	-	-	-	-	-
Vein...............	-	-	-	-	C	-	C	C
Minerals:								
Albite.............	-	-	-	-	-	-	S	A
Andesine...........	-	-	-	-	-	-	-	-
Ankerite...........	-	-	-	-	-	-	A	P
Arsenopyrite.......	-	M	-	-	-	-	-	-
Biotite............	-	-	X	S	-	A	-	-
Biotite-chlorite...	P	-	-	-	-	-	-	-
Calcite............	-	F	-	S	-	S	-	-
Cassiterite........	-	X	-	-	-	-	-	-
Chlorite...........	-	-	-	-	-	-	-	-
Chlorite clay......	-	-	-	-	M	-	-	-
Dolomite...........	-	-	-	-	-	-	-	-
Epidote............	-	-	-	-	-	-	-	-
Fluorite...........	-	-	-	-	-	-	-	-
Graphite...........	-	-	-	-	-	-	-	-
Gypsum.............	-	-	-	-	P	-	-	-
Hydrobiotite.......	-	-	-	-	-	-	-	-
Hydromuscovite.....	-	-	P	P	-	P	-	-
Limonite...........	F	T	-	-	M	-	M	M
Magnetite..........	-	-	T	T	-	-	-	-
Muscovite..........	-	-	-	-	-	-	-	-
Pyrite.............	-	S	-	-	-	-	-	-
Quartz.............	S	A	-	S	-	S	A	A
Scorodite..........	-	-	-	-	-	-	-	-
Sericite...........	A	-	-	-	-	-	-	-
Tourmaline.........	-	P	-	-	-	-	-	-
Zircon.............	-	-	-	-	-	-	-	-

See footnotes at end of table.

TABLE 29. - Petrographic identifications--continued

P - Predominant......	Over 50 percent	X - Detected in sample
A - Abundant.........	10 - 50 percent	N - Sought but not detected
S - Subordinate......	2 - 10 percent	C - Rock classification
M - Minor...........	0.5 - 2 percent	
F - Few............	0.1 - 0.5 percent	
T - Trace......	Less than 0.1 percent	

Sample[1]...........	60-141C	60-142	60-143	60-117	60-30	60-3	60-4	59-159	59-161
Trench, location..	RL-6	RL-6	RL-6	RL-9	P-5[2]	P[3]	P[3]	Daisy	Daisy
Table[1]............	11	11	11	11	17	17	17	20	20
Rocks:									
Andesite........	-	-	-	-	-	-	-	-	-
Breccia.........	-	-	-	-	-	-	-	-	-
Clay............	-	C	-	-	-	-	-	-	-
Gossan..........	-	-	-	-	-	-	-	-	-
Phyllite........	C	-	C	-	-	-	-	X	X
Quartzite.......	-	-	-	C	-	-	-	-	-
Schist..........	-	-	-	-	X	-	-	-	M
Shale...........	-	-	-	-	-	C	-	-	-
Vein............	-	-	-	-	-	-	C	-	-
Minerals:									
Albite..........	-	-	-	S	-	-	-	-	-
Andesine........	-	-	-	-	-	-	-	-	-
Ankerite........	-	-	-	-	-	-	-	-	-
Arsenopyrite....	-	-	-	-	A	-	-	-	-
Biotite.........	S	S	A	S	M	-	-	-	-
Biotite-chlorite	-	-	-	-	-	-	-	-	-
Calcite.........	-	M	-	-	-	-	-	M	-
Cassiterite.....	-	-	-	-	A	N	N	N	N
Chlorite........	S	A	S	S	A	S	M	-	M
Chlorite clay...	-	-	-	-	-	-	-	-	-
Dolomite........	-	-	-	-	S	-	-	-	-
Epidote.........	-	-	-	-	-	-	-	-	-
Fluorite........	-	-	-	-	-	-	-	-	-
Graphite........	-	-	S	-	-	S	-	-	-
Gypsum..........	-	-	-	-	-	-	-	-	M
Hydrobiotite....	-	-	-	-	-	-	-	-	-
Hydromuscovite..	A	A	P	-	-	P	-	P	P
Limonite........	-	M	-	-	A	M	M	-	T
Magnetite.......	-	-	-	-	-	-	-	-	-
Muscovite.......	-	-	-	-	S	-	-	-	-
Pyrite..........	-	-	-	-	F	-	-	M	T
Quartz..........	A	A	A	P	M	-	P	F	A
Scorodite.......	-	-	-	-	A	-	-	-	-
Sericite........	-	-	-	-	-	-	-	-	-
Tourmaline......	T	-	-	-	A	-	-	F	A
Zircon..........	-	-	-	-	T	-	-	-	-

See footnotes at end of table.

TABLE 29. - Petrographic identifications--continued

P - Predominant...... Over 50 percent
A - Abundant......... 10 - 50 percent
S - Subordinate...... 2 - 10 percent
M - Minor........... 0.5 - 2 percent
F - Few............ 0.1 - 0.5 percent
T - Trace...... Less than 0.1 percent

X - Detected in sample
N - Sought but not detected
C - Rock classification

Sample[1]...............	59-162	60-59	60-59A	60-59B	60-59C	60-59D	59-163	59-167
Trench, location......	Daisy	Daisy	Daisy	Daisy	Daisy	Daisy	LL-9	LL-12
Table[1]...............	20	20	20	20	20	20	20	20
Rocks:								
Andesite............	-	-	-	-	-	-	-	-
Breccia............	-	-	-	-	-	-	-	-
Clay...............	-	-	-	-	-	-	-	-
Gossan.............	-	-	-	-	-	-	-	-
Phyllite............	X	C	-	C	-	C	X	X
Quartzite..........	-	-	-	-	-	-	-	-
Schist.............	M	-	-	-	-	-	M	-
Shale..............	-	-	-	-	-	-	-	-
Vein...............	-	C	C	-	C	-	-	-
Minerals:								
Albite.............	-	-	-	-	-	-	-	-
Andesine............	-	-	-	-	-	-	-	-
Ankerite............	-	-	-	-	-	-	-	-
Arsenopyrite........	-	-	-	-	-	-	-	-
Biotite............	-	-	-	-	-	-	-	-
Biotite-chlorite....	-	-	-	-	-	-	-	-
Calcite............	-	-	-	-	-	-	S	-
Cassiterite.........	N	N	N	N	N	N	T	-
Chlorite............	F	-	-	-	-	F	F	F
Chlorite clay.......	-	-	-	-	-	-	-	-
Dolomite...........	-	-	-	-	-	-	-	-
Epidote............	-	-	-	-	-	-	-	-
Fluorite...........	-	T	-	-	-	-	-	-
Graphite...........	-	-	-	-	-	-	-	-
Gypsum.............	F	-	-	-	-	-	F	M
Hydrobiotite........	-	-	-	-	-	-	-	-
Hydromuscovite......	P	S	M	A	M	A	P	P
Limonite...........	T	M	M	M	M	T	M	M
Magnetite..........	-	-	-	-	-	-	-	-
Muscovite..........	-	-	-	-	-	-	-	-
Pyrite.............	T	-	-	-	-	-	T	-
Quartz.............	A	P	P	A	P	P	S	M
Scorodite..........	-	-	-	-	-	-	-	-
Sericite...........	-	-	-	-	-	-	-	-
Tourmaline..........	A	S	M	A	S	M	S	M
Zircon.............	-	-	-	-	-	-	-	-

See footnotes at end of table.

TABLE 29. - Petrographic identifications--continued

P - Predominant...... Over 50 percent		X - Detected in sample
A - Abundant......... 10 - 50 percent		N - Sought but not detected
S - Subordinate...... 2 - 10 percent		C - Rock classification
M - Minor........... 0.5 - 2 percent		
F - Few............ 0.1 - 0.5 percent		
T - Trace...... Less than 0.1 percent		

Sample[1]...........	59-168	59-169	60-82	61-1	59-192	59-193	60-2	60-1	60-6	60-7
Trench, location..	LL-10	LL-10	IC-3	BC-8	BC-8	BC-8	(4)	(5)	(5)	(5)
Table[1]............	20	20	21	24	24	24	-	-	-	-
Rocks:										
Andesite........	-	-	-	-	-	-	C	-	-	-
Breccia.........	-	-	-	-	-	-	-	-	-	-
Clay............	-	-	-	-	-	-	-	-	-	-
Gossan..........	-	-	-	-	-	-	-	-	-	-
Phyllite........	X	X	C	-	-	-	-	-	-	-
Quartzite.......	-	-	-	-	-	-	-	-	-	-
Schist..........	-	-	-	C	F	C	-	-	-	-
Shale...........	-	-	-	-	-	-	-	C	C	-
Vein............	-	-	-	-	-	-	-	-	-	C
Minerals:										
Albite..........	-	-	-	-	-	-	-	-	-	-
Andesine........	-	-	-	-	-	-	P	-	-	-
Ankerite........	-	-	-	-	-	-	-	-	-	-
Arsenopyrite....	-	-	-	-	-	-	-	-	-	-
Biotite.........	-	F	-	-	-	-	S	-	-	-
Biotite-chlorite	-	-	-	-	-	-	-	-	-	-
Calcite.........	-	-	-	-	-	-	-	-	-	-
Cassiterite.....	-	-	T	S	T	N	N	N	N	N
Chlorite........	T	F	S	-	M	-	-	S	-	-
Chlorite clay...	-	-	-	-	-	-	-	-	-	-
Dolomite........	-	-	-	-	-	-	-	-	-	-
Epidote.........	-	-	-	-	T	-	-	-	-	-
Fluorite........	-	-	-	-	-	-	-	-	-	-
Graphite........	-	-	-	-	-	-	-	-	M	-
Gypsum..........	-	-	-	-	-	-	-	-	-	-
Hydrobiotite....	-	-	-	-	-	-	-	-	S	-
Hydromuscovite..	P	P	P	-	-	P	A	A	P	-
Limonite........	T	F	S	S	M	M	-	-	-	S
Magnetite.......	-	-	-	F	-	-	-	-	-	-
Muscovite.......	-	-	-	-	-	-	-	-	-	-
Pyrite..........	-	-	-	-	N	N	-	-	-	-
Quartz..........	S	M	S	A	P	S	-	A	-	P
Scorodite.......	-	-	-	-	-	-	-	-	-	-
Sericite........	-	-	-	-	-	-	-	-	-	-
Tourmaline......	T	M	M	A	F	S	-	-	-	-
Zircon..........	-	-	-	-	-	-	-	-	-	-

See footnotes at end of table.

TABLE 29. - Petrographic identifications--continued

P - Predominant............ Over 50 percent
A - Abundant............... 10 - 50 percent
S - Subordinate............ 2 - 10 percent
M - Minor.................. 0.5 - 2 percent
F - Few.................... 0.1 - 0.5 percent
T - Trace............ Less than 0.1 percent

X - Detected in sample
N - Sought but not detected
C - Rock classification

Sample[1]................ Trench, location....... Table[1].................	60-58 (6) 27	60-58A (6) 27	60-58B (6) 27	60-58C (6) 27	60-58D (6) 27	60-58E (6) 27	60-58F (6) 27	61-8 (7)
Rocks:								
Andesite..............	-	-	-	-	-	-	-	-
Breccia...............	C	-	-	-	-	-	-	-
Clay..................	-	-	-	-	-	-	-	-
Gossan................	-	-	-	-	-	C	-	-
Phyllite..............	-	-	-	-	-	-	C	-
Quartzite.............	-	-	-	-	-	-	-	-
Schist................	C	-	C	C	C	C	-	C
Shale.................	-	-	-	-	-	-	-	-
Vein..................	C	C	C	-	-	-	-	C
Minerals:								
Albite................	-	-	-	-	-	-	-	-
Andesine..............	-	-	-	-	-	-	-	-
Ankerite..............	-	-	-	-	-	-	-	S
Arsenopyrite..........	-	-	-	-	-	-	-	-
Biotite...............	-	-	-	-	-	-	M	-
Biotite-chlorite......	-	-	-	-	-	-	-	-
Calcite...............	-	-	-	-	-	-	-	-
Cassiterite...........	N	N	N	N	N	N	N	N
Chlorite..............	-	-	-	-	T	-	M	F
Chlorite clay.........	-	-	-	-	-	-	-	-
Dolomite..............	-	-	-	-	-	-	-	-
Epidote...............	-	-	-	-	-	-	-	-
Fluorite..............	-	-	-	-	-	-	-	-
Graphite..............	-	-	-	-	-	-	-	-
Gypsum................	-	-	-	-	-	-	-	-
Hydrobiotite..........	-	-	-	-	-	-	-	-
Hydromuscovite........	-	-	-	-	-	-	A	-
Limonite..............	S	M	M	S	F	A	-	S
Magnetite.............	-	-	-	-	-	-	-	-
Muscovite.............	-	-	-	-	-	-	-	-
Pyrite................	-	-	-	-	-	-	-	A
Quartz................	P	P	P	S	P	A	P	P
Scorodite.............	-	-	-	-	-	-	-	-
Sericite..............	-	-	-	-	-	-	-	-
Tourmaline............	A	A	A	P	A	A	M	A
Zircon................	-	-	-	-	-	-	-	-

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[1] See the listed table for sample description. Letters A, B, C, etc. following the sample number designate lithological variations in the sample or specimen.

[2] P - Peluk.

[3] P - Bed of Peluk Creek.

[4] See section entitled "Drusy Quartz Vein and Andesite Dike."

[5] See section entitled "Mouth of West Fork."

[6] See section entitled "Oakland Creek-West Fork Divide."

[7] See section entitled "Summit of Big Potato Mountain."

Cassiterite occurs in three environments: (1) In fissure veins as aggregates (10-mm maximum diameter) of coarse cassiterite (1 mm); (2) in replacement veins as discontinuous border zones in the metasomatic quartz adjacent to tourmaline schist; (3) intimately associated with fine-grained tourmaline schist as minus 200-mesh grains with an average grain size of less than 5 microns (3,200-mesh).

Diamond-Drill Hole 1, 38.0 Feet. - Veinlike material in tourmaline schist at 38.0 feet in diamond-drill hole 1 (table 12) is high in quartz and pyrite as compared to the surrounding tourmaline schist. The quartz-pyrite rich areas could represent (1) areas of the original shale that were higher in silica, iron, and sulfur; (2) areas into which silica, iron, and sulfur have been introduced by boron solutions; or (3) regions of lesser pressure (in the shale being tourmalinized) into which iron sulfide and silica have migrated from adjacent areas. The quartz-pyrite areas are coarser grained than the tourmaline schists and are cut by indistinct bands of tourmaline parallel to the general schistosity.

Diamond-Drill Hole 4, 13.5 Feet. - The core sample at 13.5 feet, DDH-4 (table 15) is a shale replaced to a great extent by fine-grained hydrothermal quartz (not cryptocrystalline). Calcite veinlets cut the hydrothermal quartz and are cut in turn by recent limonite-stained gypsum veinlets.

Diamond-Drill Hole 4, 126.9 Feet. - The core sample at 126.9 feet DDH-4 (table 15) is an altered tourmaline schist with pyrite and cassiterite. Much of the pyrite has altered to limonite or goethite. The cassiterite has an average grain size of 800-mesh with 95 percent of the cassiterite less than 200-mesh. Estimates of amounts and grain size of cassiterite may include some goethite after pyrite because of the similarity of the two minerals in reflected light.

Diamond-Drill Hole 4, 131.0 Feet. - The core sample at 131.0 feet DDH-4 (table 15) is a tourmaline schist cut by calcite-filled fractures cut in turn by gypsum-filled fractures. Pyrite masses are cut by both calcite and gypsum veinlets.

Diamond-Drill Hole 4, 136.0 Feet. - The core sample at 136.0 feet DDH-4 (table 15) is a fine-grained tourmaline schist. Pyrite is distributed at random within the tourmaline schist. Calcite-filled fractures cut the tourmaline schist and are in turn cut by gypsum veinlets.

Diamond-Drill Hole 4, 138.0 Feet. - The core sample at 138.0 feet DDH-4 (table 15) is a fine-grained tourmaline schist containing irregular stringers of pyrite, up to 1 cm in length, distributed at random. Gypsum fills a multitude of fracture fissures. There is a banding in the tourmaline schist based on the amount of quartz present.

The Clays. - Fourteen earthy clay specimens from both the tin-rich areas and from the major faults were examined. The specimens usually contained shale or phyllite fragments, quartz, calcite, and gypsum. Gyrolite, one of the zeolite group, was identified in a few specimens from the tin-rich zones. A kaolin-type clay was identified in one sample from a major fault. In all other samples, the clay minerals could not be segregated or identified with the equipment available.

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