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DECEMBER 1946

UNITED STATES
DEPARTMENT OF THE INTERIOR
J. A. KRUG, SECRETARY

BUREAU OF MINES
R. R. SAYERS, DIRECTOR

REPORT OF INVESTIGATIONS

EXPLORATION OF CAPE MOUNTAIN LODE-TIN DEPOSITS
SEWARD PENINSULA, ALASKA

BY

HAROLD E. HEIDE, WILFORD S. WRIGHT, AND ROBERT S. SANFORD

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By Harold E. Heide,[2] Wilford S. Wright,[2] and Robert S. Sanford[3]

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ILLUSTRATIONS

1/ The Bureau of Mines will welcome reprinting of this paper provided the following footnote acknowledgment is used, "Reprinted from Bureau of Mines Report of Investigations 3978."
2/ Mining Engineer, Juneau, Alaska.
3/ Acting chief, Alaska Division, Mining Branch, Juneau, Alaska.

INTRODUCTION

The United States production of tin has always been negligible, and domestic requirements have been met almost entirely by imports. The advent of war in Europe in 1939 brought a threat to our foreign source of supply, and steps were taken by Congress to forestall shortages of tin and other metals. By authority of the Strategic Minerals Act, passed by Congress in 1939, the Bureau of Mines and Geological Survey conducted investigations of domestic tin deposits.

An examination of Alaska deposits was undertaken in 1940 and 1941 by J. B. Mertie, Jr., and Robert R. Coats of the Geological Survey.

H. E. Heide conducted a preliminary examination of lode and placer-tin deposits at Cape Mountain in 1942, which was followed in 1943 and 1944 by a program of exploration by churn drilling in the placer area and trenching and sampling the lode deposits.

Placer tin, found at the head of Goodwin Gulch, Cape Creek, First Chance Creek, and Boulder Creek, indicates that the mineral was derived from the vicinity of lode cassiterite occurrences on Cape Mountain. Placer tin led to the discovery of at least one cassiterite vein by the Geological Survey and the Bureau of Mines.

ACKNOWLEDGMENTS

In its program of exploration of mineral deposits, the Bureau of Mines has as its primary objective the more effective utilization of our mineral resources to the end that they make the greatest possible contribution to national security and economy. It is the policy of the Bureau to publish the facts developed by each exploratory project as soon as practical after its conclusion. The Mining Branch, Lowell B. Moon, chief, conducts preliminary examinations, performs the actual exploratory work, and prepares the final report. The Metallurgical Branch, R. G. Knickerbocker, chief, analyzes samples and performs beneficiation tests. Both these branches are under the supervision of Dr. R. S. Dean, assistant director.

The Alaska Division, Mining Branch, is under the direction of R. S. Sanford, acting division chief. The chemical analyses included in this report were performed at Rolla, Mo., under the direction of C. Travis Anderson, chief metallurgist, Rolla Division, Metallurgical Branch.

Acknowledgment is made to the Federal Geological Survey for the use of geologic maps of the Cape Mountain tin area and reports of tin deposits on Seward Peninsula.

Special acknowledgment is made to P. L. Killeen, assistant geologist of the Geological Survey, whose detailed study of the area influenced the Bureau's selection of trench locations; to Carl M. Welte, director and principal stockholder of the Empire Tin Mining Co. for contributing historical information; and to Leo Satz and William L. Falkner, project foremen in 1943 and 1944, respectively, from whose field notes much data in this report was obtained.

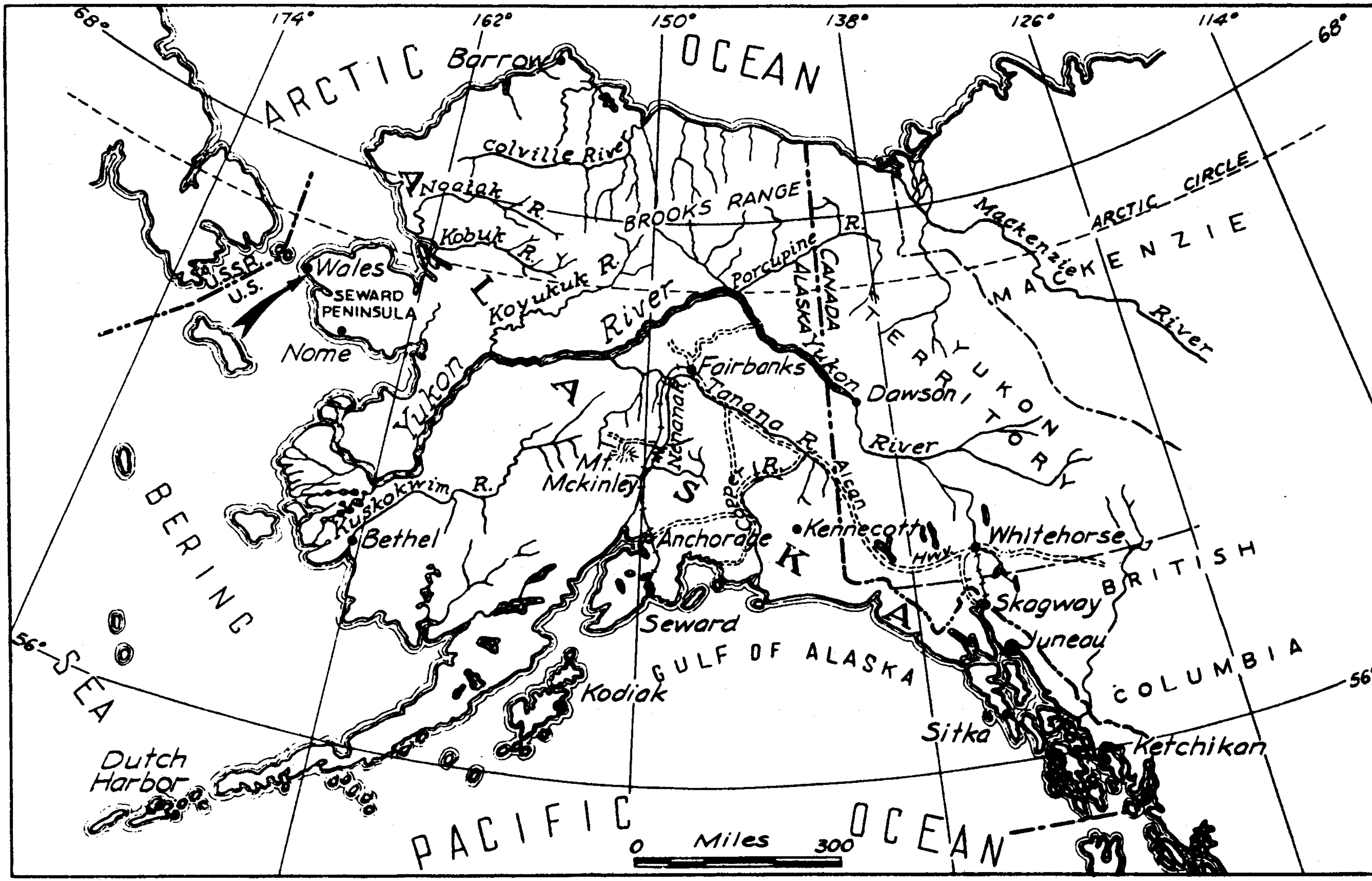


FIG. I.— INDEX MAP OF ALASKA.

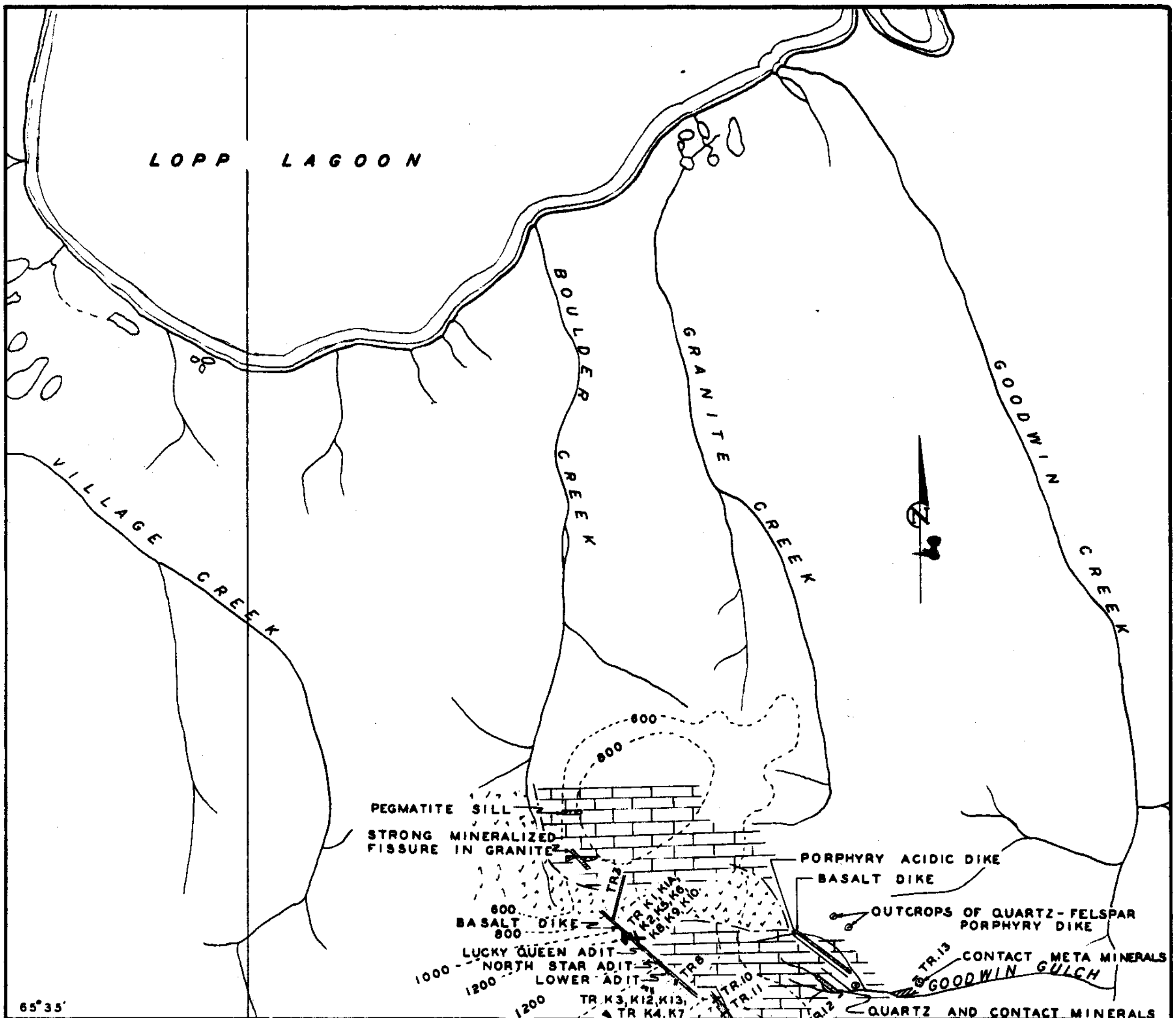


FIG. 2.— CAPE MOUNTAIN LODE-TIN DEPOSIT, SEWARD PENINSULA.

LOCATION AND ACCESSIBILITY

The Cape Mountain lode-tin zone is located at the extreme end of the North American Continent, only 3 miles from Bering Strait, at 65° 35' N. latitude and 167° 59' W. longitude. It is 107 miles by airline northwest of Nome, the distributing center for the Seward Peninsula. Tin mineralization outcrops on the east flank of Cape Mountain, in the area at the headwaters of four creeks, namely, Cape, First Chance, Boulder, and Goodwin. Figures 1 and 2 show the general location of the deposit.

Tin City, on the shore of the Bering Sea, is now deserted, but it would provide a suitable base for starting operations in the district. Wales, the nearest inhabited village, has a post office, a small trading post, a radio station, and a population of about 50 Eskimos. The area is isolated, and the common means of communication are lacking. An airplane landing field suitable for small planes has been constructed just east of Tin City. A larger airfield was built by the Civil Aeronautics Authority at Wales soon after the field work for this project was completed. Weather conditions make flying an uncertain means of transportation.

A coastwise steamer makes two or three trips between Seattle and Kotzebue during the season when the Bering Sea is open to navigation. The first ship leaves Seattle about May 20 and the last boat leaves late in August or early September. All ships are scheduled to depart from the Arctic Ocean and Bering Strait before October 6, as the ocean may freeze and close navigation shortly after that date. There is no harbor at Tin City or Wales, and vessels must anchor off shore. All freight has to be lightered from ship to shore. A tug and lighter must be chartered and come from Teller to handle heavy freight. Eskimos with umiaks, or skin boats, can be hired to lighter small articles weighing less than 1,000 pounds at about $10.00 a ton.

The average freight rate from Seattle to Nome is $30.00 a ton, plus a 16-percent surcharge that is still in effect (April 1946). Lighterage rates at Nome are 55 percent of the freight rate.

A small motorship carries mail and light cargo from St. Michaels to Kotzebue every 2 weeks during the open season. This ship will also tow a barge on request. Stops are made at Nome, Teller, Wales, and other wayside ports. Freight rates from Nome to Tin City are about $30.00 a ton shore-to-shore.

In June 1945 the Alaska Steamship Co. announced its postwar plans to enlarge its shipping facilities into these waters. If a mine were developed and a large organization could guarantee return freight to Seattle, a reduction in freight rates could probably be secured.

Equipment and supplies can be transported from Tin City to the mine on Cape Mountain by tractor and trailer or truck. A road suitable for truck haulage follows up Cape Creek to the head. Cargo could be transported the remaining half mile by tractor and trailer.

PHYSICAL FEATURES AND CLIMATE

Cape Mountain is a dome-shaped peak rising abruptly from the Bering Strait to an altitude of 2,250 feet. The seacoast on the west side of the cape is steep and has no sheltered harbors. At 1,000 feet above sea level the mountain is flanked by a narrow terrace; above this elevation slopes are very steep. South and east of the mountain the country is characterized by low relief and offers an easy approach to within one-half mile of the old Bartell mine. The north side of the mountain slopes evenly to Lopp Lagoon, which receives the greater part of the Cape Mountain drainage. The north slopes are drained by Boulder, Granite, and Goodwin Creeks, all small streams flowing northward into Lopp Lagoon, thence to the Arctic Ocean, and by Village Creek, flowing northwest into the Bering Strait. Cape Creek, flowing into Bering Strait, affords the principal drainage on the south slope.

No trees are found in this area, as vegetation is of the usual tundra variety.

The climate of the region is arctic. High-velocity winds blow almost continually, and rains are prevalent during the short summers. Throughout the year, except for a few weeks in July and August, freezing temperatures occur at some hour of the day. The winters are severe, with temperatures frequently reaching minus 50° F.

Muck and gravel underlying tundra are frozen the year around. In some cases tundra-covered surfaces are underlain by 40 feet or more of ice, with only a few feet of earth.

Winter freezing conditions from October to May stop all flow in streams of the area. Bering Sea is frozen from November to June, when the ice packs drift north through the straits.

LABOR AND LIVING CONDITIONS

All experienced labor must be imported. The Eskimos provide adequate unskilled labor and are intelligent enough to be trained for skilled and semi-skilled work. The natives are fairly industrious and, with guidance by a skeleton crew of miners and mechanics, would supply ample labor for an operation of moderate size.

Standard hourly basic wage rates are as follows:

Bulldozer operator	$1.70
Tractor operator	1.60
Dragline operator	2.00
Crane operator	1.85
Truck driver, heavy-duty	1.40
Truck driver, light equipment	1.10 and 1.20
Truck driver, extra-heavy	1.55 (10 whl.diesel)
Welder, Plumber	1.615
Electrician	1.565
General helper	1.165
Handyman	1.315
Carpenter	1.75
Laborer	1.015

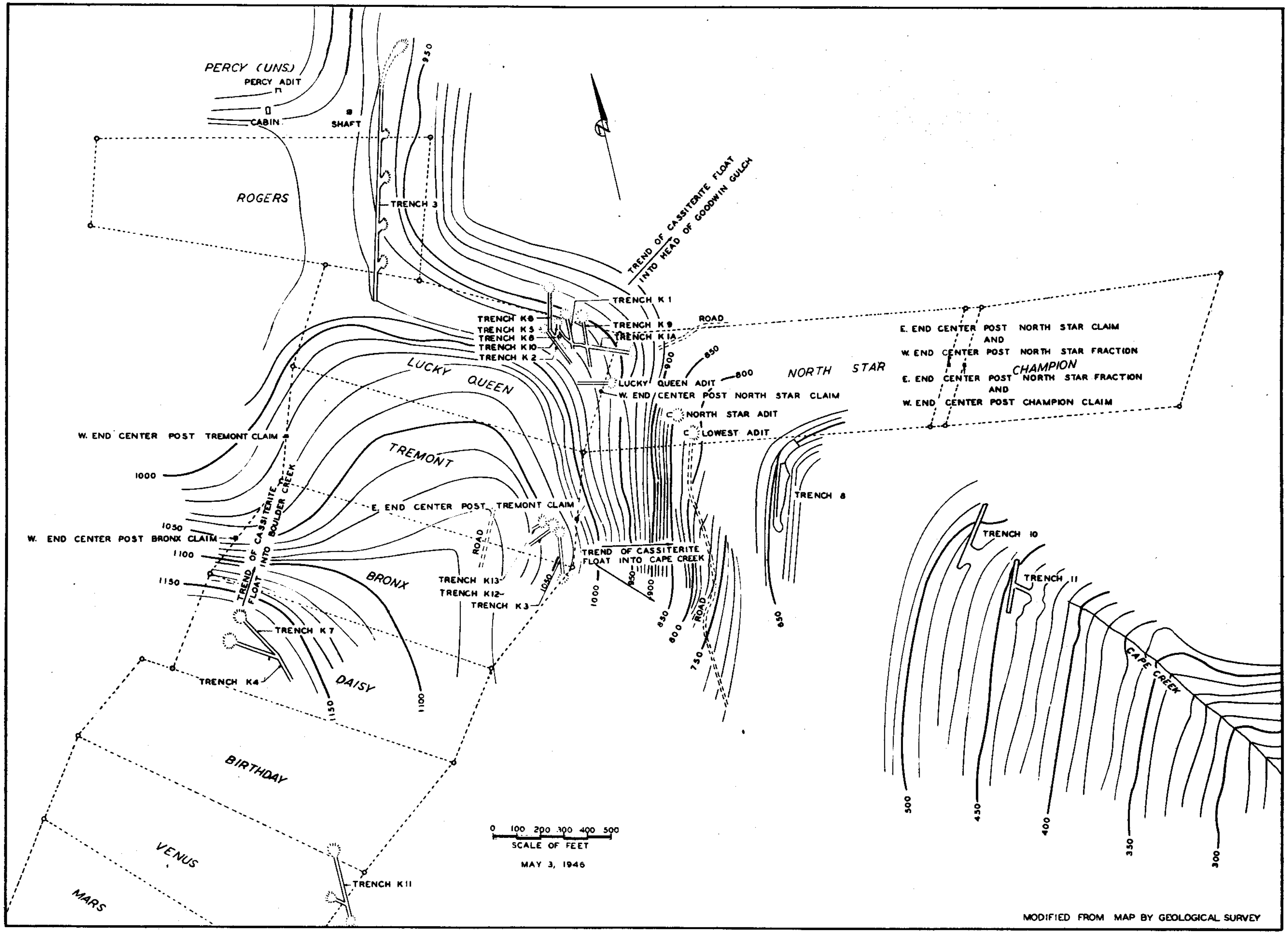


FIG. 3.— LOCATION OF TRENCHES AND ADITS AT CAPE MOUNTAIN LODE-TIN DEPOSITS, SEWARD PENINSULA, ALASKA.

There are no housing facilities at Cape Mountain. Nome, with a population of 1,200, is the nearest source of ordinary supplies. Lode-mining equipment and supplies are not stocked by local merchants and would have to be brought from Seattle.

HISTORY, PRODUCTION, and OWNERSHIP

Tin was discovered on Cape Mountain in 1903 by a prospector named Bartels, who took specimens of the cassiterite to New York City where he succeeded in interesting many people in his discovery. The Bartels Tin Mining Co. was formed, in which Bartels is reported to have held 50 percent of the stock. Buildings were erected, a mill was built, machinery was installed, and development of the Cape Mountain deposits was started. In 1905 the company produced 10 short tons of concentrate carrying 64 percent tin and shipped it to England. It is reported that the shipment was lost in transit, and the company did not receive payment for the concentrate.

In 1909, after a survey of the property had been made by Fay, a mining engineer, the directors formed a new company called the Empire Tin Mining Co. Very little work was done on the property after that time, although the Empire Tin Mining Co. at one time engaged another mining engineer named McClellan to make an extensive examination of the deposit.

The only known surviving stockholders of the old company are Henry G. Krakaur of New York City and Carl M. Welte, 34 East Town Street, Norwichtown, Conn.

In 1909 the Bartels Tin Mining Co. patented 28 lode claims and 1 mill-site, as shown on Survey 336, A and B, as follows: Rogers, Lucky Queen, Tremont, North Star, Champion, Bronx, Daisy, Birthday, Venus, Mars, Jupiter, Saturn, Excelsior, Aurora, Elgin, Washington, Adams, Jefferson, Madison, Monroe, Planet, Rusty, Tin Quartz, Noble, Mispickel, Northstar Fraction, Martha, and Fourth of July lode claims and the Northwestern mill-site claim. The same company patented 7 lode claims and 1 mill-site, as shown on Survey 337, A and B, as follows: Aspen, Sun Drum, Canoe, Comstock, Sunrise, Fairview, and Arctic lode claims and Bartels mill-site claim. The total area of these 37 claims is 456.81 acres.

The principal mine workings are on North Star and Lucky Queen claims, (see fig. 3).

It has been reported that Fred D. Crane, 545 West 111th Street, New York 25, N. Y., and associates are negotiating with the Empire Tin Mining Co. to purchase the Bartell property.

The U. S. Alaska Tin Mining Co. patented the following claims: Dieter No. 1, Dieter No. 2, and Dieter No. 3 lode claims and the U. S. mill site. Patent Survey 409, A and B, was approved October 26, 1909. The total area is 33.95 acres.

Placer operations were carried on in the small creeks near Tin City as late as 1940, but more recently the only placer mining has been by hand methods.

MINE WORKINGS

The Bartell mine consists of three principal levels and a sublevel. The general location of the mine is shown on figure 3. The Lucky Queen, North Star, and Lowest adits occur at elevations of 960, 851, and 788 feet, respectively. A raise near the limestone-granite contact connects the Lowest adit with a sublevel at 819 feet, from which the North Star adit can be reached by an inclined raise. The general trend of the North Star and Lowest adits is N. 54° W., whereas the Lucky Queen adit bears S. 73° W. A plan and section through these workings is shown on figure 4.

A crosscut 245 feet from the portal of the Lowest adit bears N. 8° E. a distance of 62 feet, thence N. 50° E. for 15 feet. The crosscut also extends 20 feet south of its intersection with the drift. Twenty feet north of the intersection a branch crosscut bears N. 67° E. for a distance of 39 feet.

Sublevel workings consist of 66 feet of drifting and 105 feet of crosscutting. The crosscut parallels the Lowest adit crosscut, and the drift has a bearing of N. 75° W.

Sixty-five feet from the North Star portal is a winze joining the North Star and sublevel. At a point 90 feet from the portal a drift bears N. 35° W. for 28 feet, and at 116 feet from the portal another drift bears north 25 feet; these two drifts are joined at their extremities by a 12-foot crosscut. A small amount of low-grade ore was found in the second drift.

At a point 60 feet farther inside a drift bears S. 10° E. for 38 feet along a system of fractures. A 3-inch stringer containing high-grade tin ore was exposed in this drift.

The entire workings of the North Star adit amount to 575 feet; that of the Lowest adit is 403 feet.

The Lucky Queen adit is 143 feet long, and 62 feet from the portal two short crosscuts extend 10 feet into the granite on each side of the drift.

Workings on the Percy and Canoe claims were caved or filled with ice, and no attempt was made to gain access.

ORE DEPOSITS

Geology

The geology of the Cape Mountain area is summarized by the Geological Survey[4] as follows:

> A large granite intrusive constitutes the core of the mountain. Bordering it on the north and east are limestone beds into which the granite has been intruded. In places portions of the limestone roof which once covered the granite, still remain. The granite is closely associated with granitic veins. Both the limestone and the granite

4/ Steidtmann, Edward, and Cathcart, S. H., Geology of the York Tin Deposits, Alaska: Geol. Survey Bull. 733, 1922, pp. 97-101.

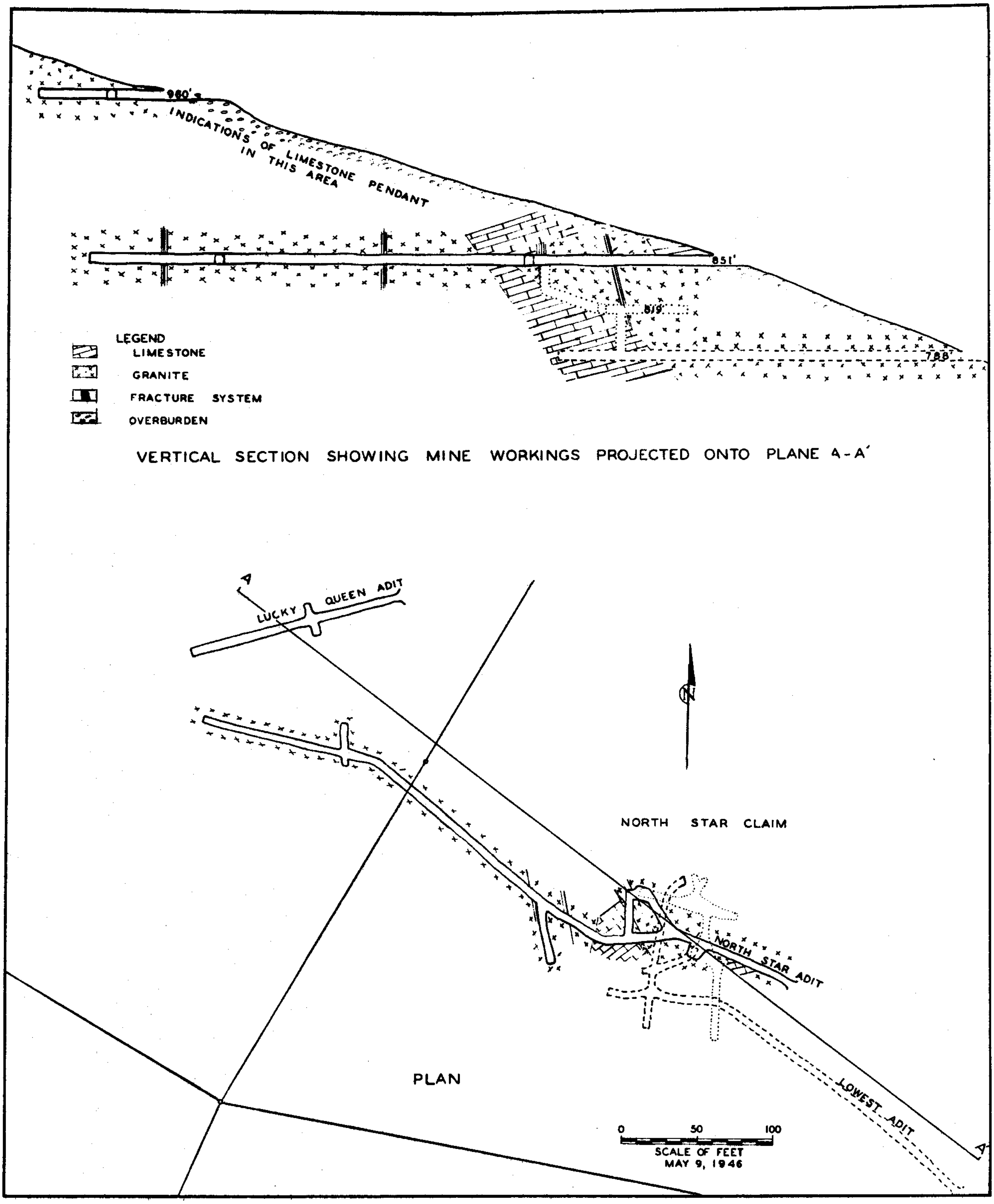


FIG. 4.-PLAN AND SECTIONAL VIEW, BARTELL MINE, CAPE MOUNTAIN, SEWARD PENINSULA, ALASKA.

show contact metamorphic phases. The youngest rock of the area is an intrusion of black olivine porphyry, which in the form of dikes cuts both limestone and granite.

The visible portion of the granite intrusion is a dome-shaped mass about 3 miles in diameter and over 2,000 feet high. The contact surface with the limestone appears to be nearly vertical on the east but dips more gently to the north. It is irregular, the granite having welled upward into the limestone along vertical planes and also between the limestone beds. Occasionally limestone blocks are found which foundered into the granite. A boulder of granite on the dump of the United States Alaska Tin Mining Co. tunnel contains a block of limestone about 6 inches in diameter. Between Lagoon (called Boulder Creek on later maps) and Village Creeks an area of several hundred acres is underlain by limestone partly submerged in the granite while it was still in a molten condition. The granite on top of the mountain is covered by several feet of limestone overlain by about 200 feet of fine-grained quartz-biotite schists.***

The limestone at Cape Mountain is composed chiefly of calcite, with some admixture of quartz. In color it is generally white to bluish gray. Beds of quartz sand, now changed to quartzite, averaging about 5 inches in thickness, occur at intervals of about 15 to 20 feet***.

East of the granite contact the limestone beds dip toward the granite at an angle of about 15°. Between Lagoon and Barluk Creeks they dip east. North of the granite intrusion they dip north away from the granite. It does not appear that the intrusion of the granite has produced the present attitude of the limestone beds.

The changes which the limestone has suffered because of the intrusion of the granite fall into two classes - those which involve the introduction of materials and those which do not. The changes which do not involve the introduction of materials are as follows: "Near the contact the limestone has been changed into a dense white quartzite by the recrystallization of the quartz grains. Wollastonite has commonly formed by a reaction between the calcite and the quartz grains, and locally the quartz beds have been changed completely into wollastonite. The change from calcite and quartz to wollastonite involves the loss of carbon dioxide from calcite and the combination of the lime as silica.

Close to the contact the limestone was locally invaded by hot tin-bearing solutions which converted it into a heavy medium to coarse-grained rock. The altered zones appear to have a maximum width of only a few feet and are found immediately adjacent to the granite and along fissures that cut the limestone in the vicinity of the granite***. The principal minerals of this green rock are green pyroxene and green tourmaline. Minor constituents are pyrite, pyrrhotite, fluorite, scapolite, accessory sphalerite, quartz, and cassiterite***. The cassiterite is yellowish brown, fine-grained, and irregularly distributed through the rock***.

The tin-bearing solutions that altered the limestone along the granite contact have also affected the border portions of the granite itself. On the dumps of the Empire Tin Co.'s workings samples of granite were found showing a local fracturing along which minute seams of cassiterite and tourmaline had been introduced. They formed a cement and also replaced the feldspars. Pyrite in minute scattered grains, accompanied the cassiterite and tourmaline.

Geology of Bartell Mine

Tin deposits at the Bartell mine occur in proximity to the granite-limestone contact, and in both granite and limestone. A conspicuous feature are the numerous limestone pendants in the granite, which in a few places occur as comparatively large blocks of limestone.

Tin deposition has occurred along weak north-south tension or shear fractures in the granite and in the limestone.

Both rock fracturing and mineral deposition have been weak. Fractures in the granite appear to be little more than minor shear planes. In most cases there is very little indication of mineralization or alteration of the wall rock. No large fissures were observed in the granite. Tin deposition along the shear planes is weak and highly irregular.

Fractures in the limestone are generally narrow, although locally they may be extended by brecciation and replacement. Few of them appear to be over 100 feet long. Mineralization is usually more pronounced in or adjacent to the limestone than in the granite; and quartz, actionolite, tourmaline, limonite, and sparse sulfides are more common.

At several places underground, quartz stringers and fractures in the granite were observed to terminate abruptly at a limestone contact.

In the Bartell mine, mineral solutions appear to have ascended locally through fractures in the granite. Where such favorable channels encounter limestone, the solutions have followed the irregular contact, occasionally breaking across fractures in the limestone.

The lateral extent of individual deposits appears to be small in both granite and limestone. It appears that deposits in limestone, at the Bartell mine, will be shallow, as at this location all limestone consists of small blocks or roof pendants in granite. There is a possibility that tin may occur east of Bartell mine near the head of Goodwin Gulch, where the limestone is apparently of considerable depth.

As mineral exposures in the granite are limited, only geologic inferences are warranted. No large economic deposits have been observed in the granite. If tin-bearing solutions have ascended along favorable channels in the granite, some deposition may occur to great depth, but there is no evidence to suggest that there will be an enlargement of observed structures.

Surface data, in regard to "float" and placer deposits, do not indicate the presence of any large tin outcrops in the past or present. It is concluded from the distribution and character of surface float that a few outcrops, other than those now exposed, do exist, but from the evidence these are thought to be small.

Tin placer mining has been carried on along Cape and First Chance Creeks and also along Goodwin Gulch. During Bureau of Mines investigation of placer-tin deposits in the region, several small areas of virgin gravel were found near the old workings of the three creeks mentioned above. A small deposit of placer tin was found in Boulder Creek valley. The gravels of Granite and Village Creeks were found to contain only traces of tin.5/

Because an examination of much of the rock surface is obscured by debris and only a few mineralized points can be observed underground, it should not be definitely stated that undiscovered deposits do or do not exist. However, as stated above, there is nothing to suggest that intensive mineralization has taken place anywhere.

There is evidence in old prospect pits near the head of Goodwin Gulch, as well as in trenches K1A and K5 excavated by the Bureau, that several granitic dikes striking north to northwest exist in the tin-bearing area. These may be genetically associated with tin deposition.

A limited similarity in geological structure exists between Cape Mountain and Lost River tin deposits, where the Bureau of Mines has excavated over 5,700 feet of trenches, completed 22 core-drill holes totaling 8,693 feet, and collected 1,685 samples. Excerpts from Report of Investigations 3902, Lost River Tin Mine (in press) are quoted herein to indicate possible subsurface conditions at Cape Mountain.

Occurrence of Deposits (at Lost River)

Three principal types of deposits occur, namely in acidic dikes, in the contact metamorphic zone, and in the granite. Deposits in the acidic dikes have been described in many Geological Survey publications and by engineers in private practice; but previous to exploration by the Bureau of Mines no ore reserves were known to exist in the granite and contact zone.***

Contact Metamorphic Zone (at Lost River)

Surface exposures and diamond-drill cores show the zone to be composed of a complex group of rocks and minerals. Originally limestone, the country rock has been brecciated, probably both by faulting and explosive forces from the granite magma. Acidic and basic dikes of all sizes have intruded the limestone and, in many instances, form a matrix around limestone fragments. Nearly the entire zone appears

5/ Bureau of Mines, War Mineral Rept. 164, Cape Mountain Placer Tin Deposits: May 1943, rewritten by Washington staff as report of investigations.

to have been invaded by gases and mineralized solutions that have altered or replaced the original minerals. Tin is found in varying amounts throughout the zone. The most active agent appears to have been fluorine, and locally the rock consists wholly of fluorite. Slickenside and abraded breccia fragments were observed in many places in the drill cores, and indicate the presence of numerous faults.

Deposits in Granite (at Lost River)

Granite does not outcrop at the Lost River mine, but it was encountered in Bureau of Mines drill holes and has been shown to be tin-bearing. Near its contact with the limestone the granite is highly altered and is essentially kaolin with lesser fluorite, topaz, quartz, galena, sphalerite, and chalcopyrite. This phase carries only small quantities of tin. In general the granite becomes progressively less altered with distance from the contact. Six drill holes disclose that the strongest tin mineralization is not at the contact, but instead occurs within the granite, at a maximum distance of 40 feet from the contact.[6]

Description of Ore Bodies

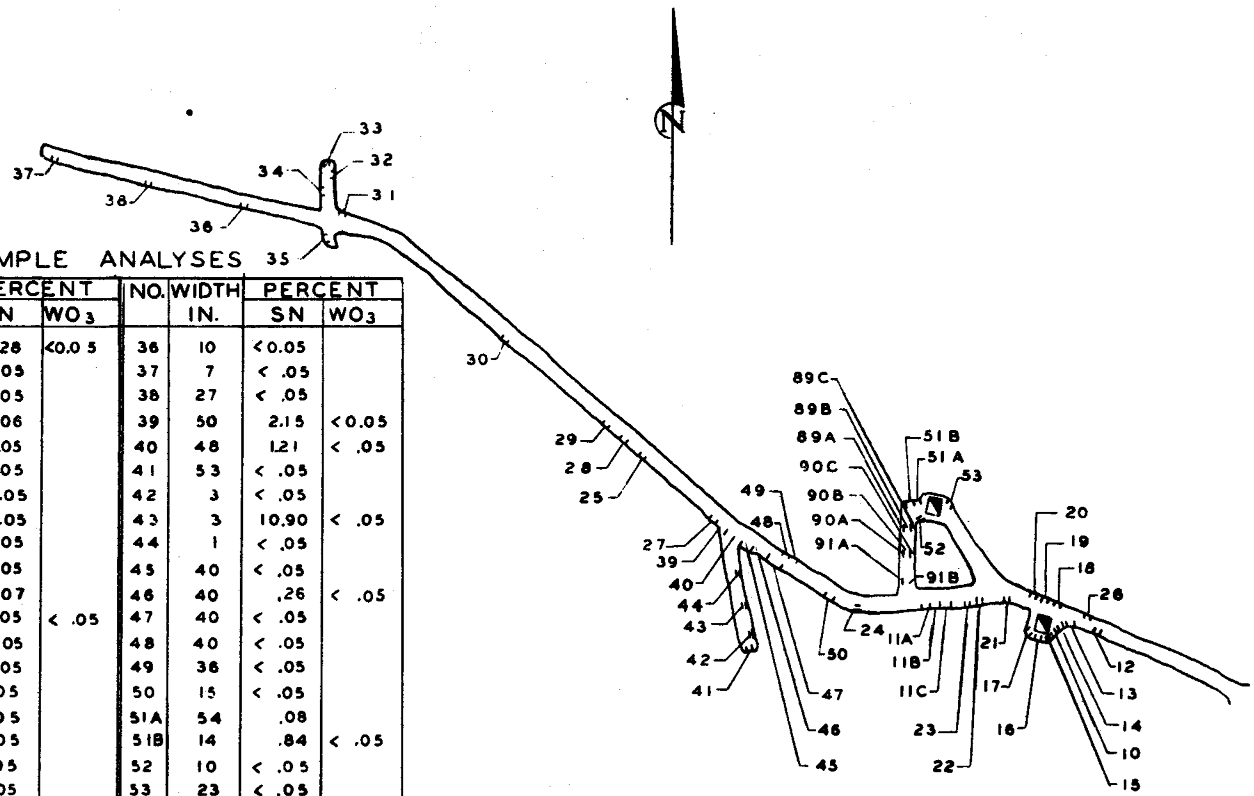
Four small ore bodies are indicated by Bureau work. One is in the so-called "Big Ledge" zone shown on old maps. It is exposed in only the North Star adit where it is represented by Bureau samples 27, 39, 40, 41, 42, 43, 44, 45, 46, and 47. (See fig. 5.) These samples do not outline an ore body of definite width or length.

Another alleged ore body is indicated in "Brooklyn" crosscut on North Star adit. A length of about 30 feet is represented by samples series 51, 89, 90, and 91. This same shoot was sampled in the winze and on the sub-level. Samples representing this shoot are shown in figures 5 and 6.

Samples 10 and 19 may indicate an ore shoot in the North Star adit, but the structure is very weak. Sample analyses shown in figure 7 indicate no corresponding values in the Lowest adit.

The surface vein discovered by combined exploration of the Bureau of Mines and Geological Survey is the most promising tin deposit found on the Bartels property. This is a quartz-mica-cassiterite vein occurring principally in limestone, with some tin also occurring in the adjacent granite. It is approximately 150 feet in length, ranges from a few inches to about 66 inches in width, and has an average width of 17 inches. Cassiterite occurs as coarse grains and large nuggets in both quartz and mica. The average of 18 samples collected and analyzed by the Bureau is 7.24 percent tin.

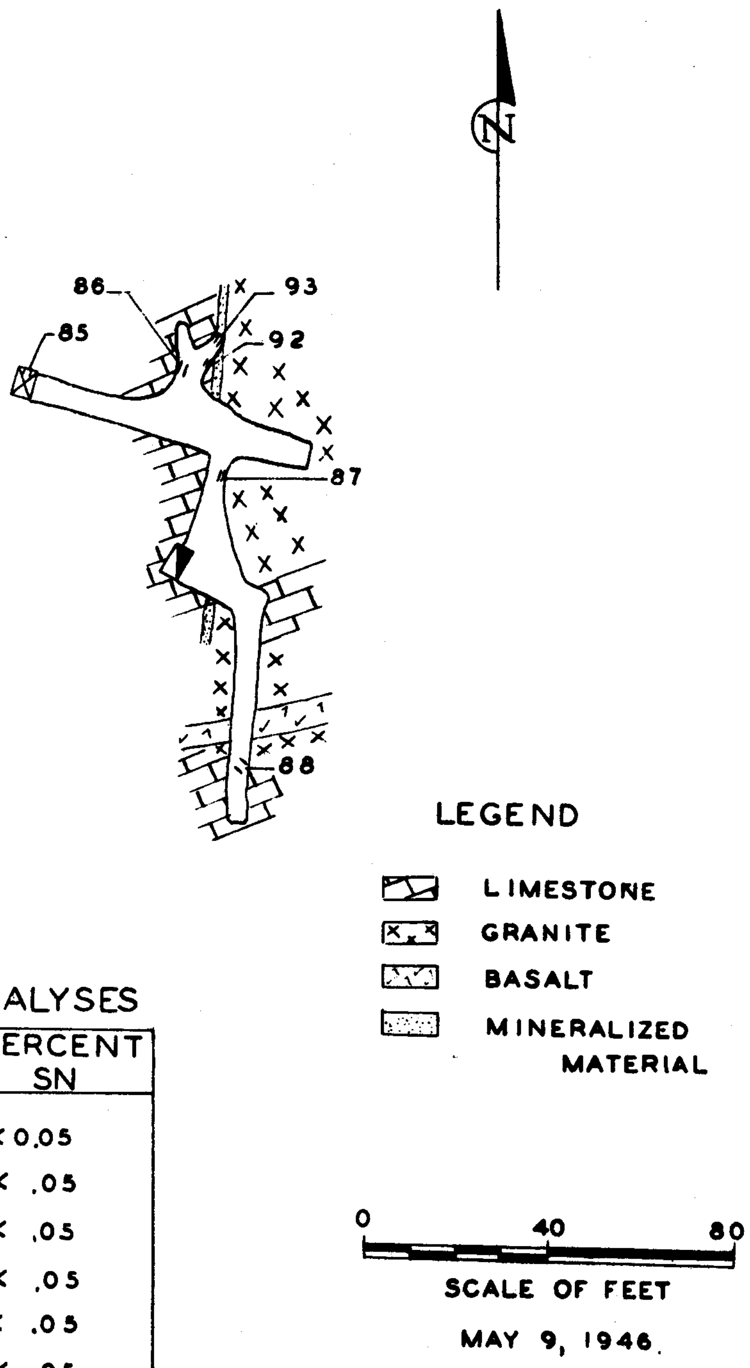
6/ Heide, Harold E. Lost River Tin Mine, Seward Peninsula, Alaska: Rept. of Investigations 3902. In press.



SAMPLE ANALYSES

NO.	WIDTH	PERCENT		NO.	WIDTH	PERCENT	
	IN.	SN	WO_3		IN.	SN	WO_3
10	11	1.28	<0.05	36	10	<0.05	
11A	28	< .05		37	7	< .05	
11B	41	< .05		38	27	< .05	
11C	64	.06		39	50	2.15	<0.05
12	14	< .05		40	48	1.21	< .05
13	12	< .05		41	53	< .05	
14	12	< .05		42	3	< .05	
15	5	< .05		43	3	10.90	< .05
16	15	< .05		44	1	< .05	
17	15	< .05		45	40	< .05	
18	6	.07		46	40	.26	< .05
19	8	6.05	< .05	47	40	< .05	
20	12	< .05		48	40	< .05	
21	15	< .05		49	36	< .05	
22	8	< .05		50	15	< .05	
23	10	< .05		51A	54	.08	
24	16	< .05		51B	14	.84	< .05
25	9	< .05		52	10	< .05	
26	7	< .05		53	23	< .05	
27	60	.88	< .05	89A	18	.29	< .05
28	39	.27	< .05	89B	31	.57	< .05
29	19	< .05		89C	50	< .05	
30	63	.22	< .05	90A	59	.06	
31	12	< .05		90B	25	< .05	
32	3	< .05		90C	55	1.91	< .05
33	27	< .05		91A	34	.53	< .05
34	18	< .05		91B	30	2.09	< .05
35	4	< .05					

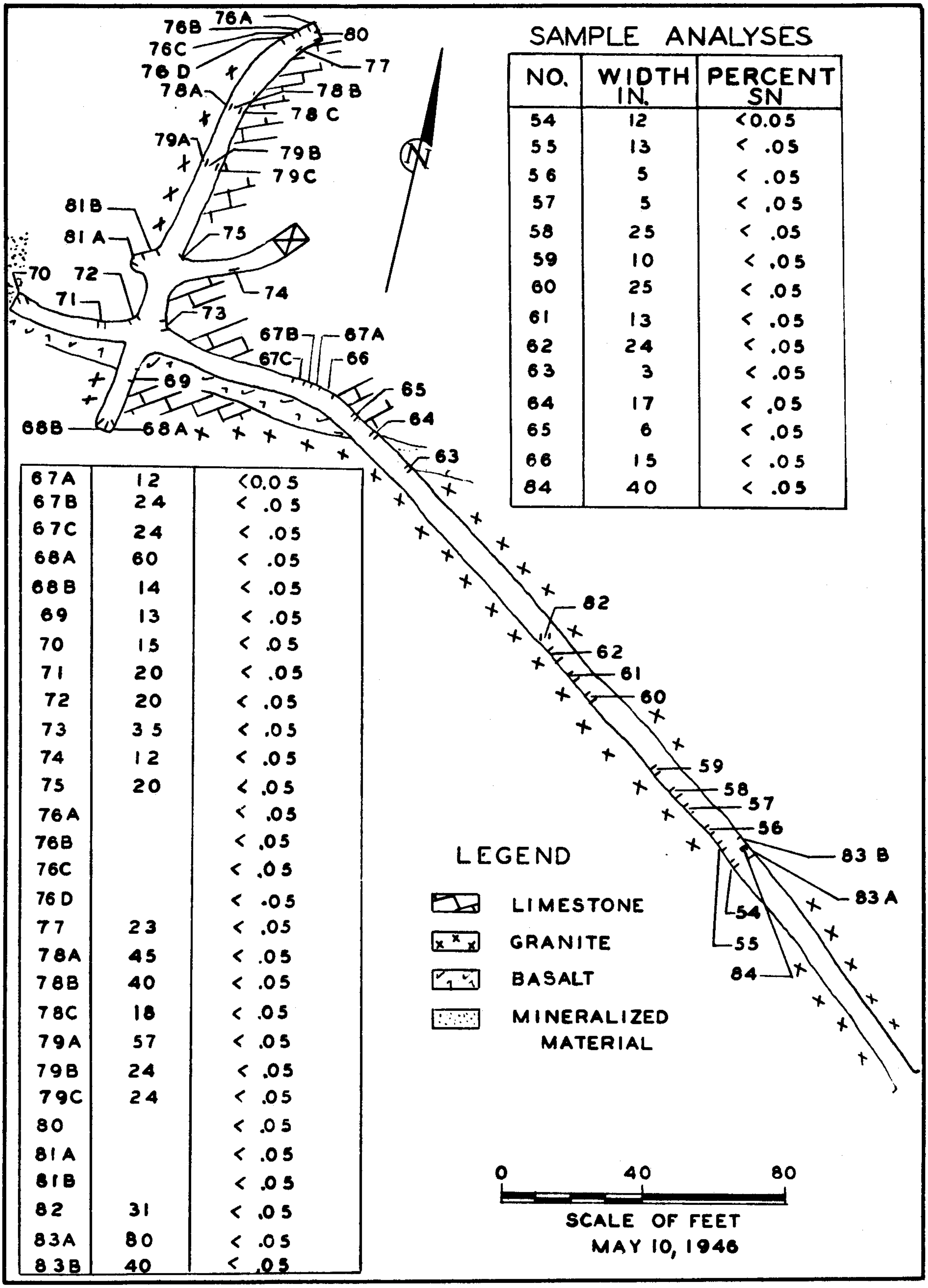
FIG. 5.-LOCATION AND ANALYSES OF SAMPLES IN BARTELL MINE - NORTH STAR ADIT



SAMPLE ANALYSES

NO.	WIDTH IN.	PERCENT SN
85	17	<0.05
86	10	< .05
87	10	< .05
88	12	< .05
92	10	< .05
93	30	< .05

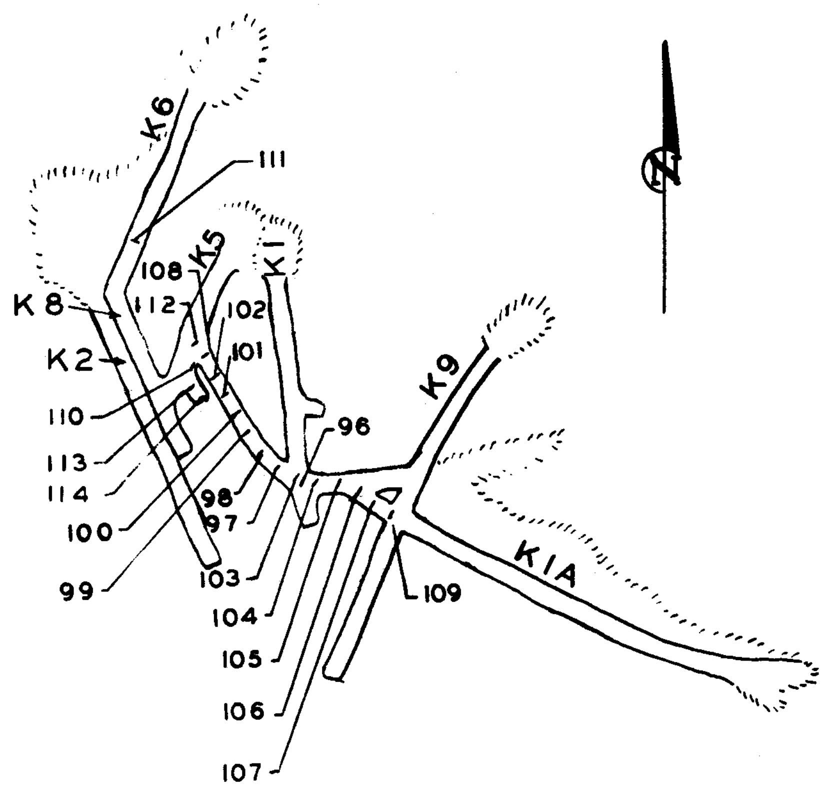
FIG. 6.- SUBLEVEL, BARTELL MINE, SEWARD PENINSULA.



SAMPLE ANALYSES

NO.	WIDTH IN.	PERCENT SN
54	12	<0.05
55	13	< .05
56	5	< .05
57	5	< .05
58	25	< .05
59	10	< .05
60	25	< .05
61	13	< .05
62	24	< .05
63	3	< .05
64	17	< .05
65	6	< .05
66	15	< .05
84	40	< .05
67A	12	<0.05
67B	24	< .05
67C	24	< .05
68A	60	< .05
68B	14	< .05
69	13	< .05
70	15	< .05
71	20	< .05
72	20	< .05
73	35	< .05
74	12	< .05
75	20	< .05
76A		< .05
76B		< .05
76C		< .05
76D		< .05
77	23	< .05
78A	45	< .05
78B	40	< .05
78C	18	< .05
79A	57	< .05
79B	24	< .05
79C	24	< .05
80		< .05
81A		< .05
81B		< .05
82	31	< .05
83A	80	< .05
83B	40	< .05

FIG. 7.– LOWEST ADIT, BARTELL MINE, SEWARD PENINSULA.



SAMPLE ANALYSES

NO.	WIDTH	PERCENT SN
97	12"	4.14
98	12"	14.44
99	12"	1.99
100	12"	< .05
101	6"	< .05
102	6"	.12
103	12"	1.12
104	12"	1.47
105	12"	3.58
106	12"	32.93
107	12"	3.28
108	66"	5.12
109	12"	3.73
110	33"	.24
111	22"	.12
96	10	14.57
113	24"	14.86
114	24"	25.02

SCALE OF FEET

MAY 13, 1946

FIG. 8.– TRENCH SAMPLES, CAPE MOUNTAIN, SEWARD PENIN.

The location and analyses of these samples are shown on figure 8. The vein was first exposed by two bulldozer trenches K1 and K2 excavated above quartz-cassiterite float on the south side of the head of Goodwin Gulch. Trenches K1 and K2 were excavated in 1943, and the following description was written at that time. These trenches, as shown on figure 3, are in the area immediately north of Lucky Queen workings. Trench K1 is 140 feet long and trends N. 7° W.; K2, the more westerly, is 135 feet long and trends N. 18° W. The old Lucky Queen tunnel trends S. 78° W. and its portal is approximately 190 feet from the south end of trench K1.

Trench K1 is in limestone, except at the south end, where disintegrated granite was exposed beneath the limestone. Bedrock surface in this area was 2 to 7 feet below ground surface. Trench K2 is entirely in soft, disintegrated granite, although there is evidence that limestone occurs immediately south of the trench.

The west wall of K1 yielded nuggets of cassiterite at points roughly 4, 27, 29, 32, 36, 42, 50, and 59 feet from the south end of the trench; similar tin ore was found on the east wall 24, 42, 67, and 82 feet from the south end. The vein pinches and swells and trends N. 50° W.; the dip varies from 60° NE. to vertical. Cassiterite was exposed at the northwest end of the lode in two 8-inch quartz veins separated by a 6-inch limestone band; the cassiterite was confined to a 1-inch border adjacent to the limestone. The vein to the southeast on the west wall of trench K1 was 4 to 5 inches wide and consisted of vein quartz and 3 inches of cassiterite. Farther southeast in the floor of the main cut, it narrows to 1 inch of massive vein material for several feet in length, and, still farther southeast, consists of white milky quartz with considerable cassiterite. A 4-pound cassiterite nugget was found in place in the west wall of the trench just at bedrock surface.

Trench K2, at a point 35 feet from its south extremity, exposed tin ore disseminated in soft, disintegrated granite. The vein exposed in trench K1 evidently does not extend into the "granite cut" unless it is represented by a narrow quartz-tourmaline vein 108 feet north of the south end of K2. Hand-trenching suggested that the course of the vein was somewhat curved and tended to strike more northerly at the northwest end.

Bulldozer trenching during 1944, along the strike of the vein, revealed a somewhat wavering course. Trench K1A exposed the vein for 50 feet northwest and 66 southeast of the 32-foot station on K1, which, for the purpose of this report, is designated station 0. Courses northwest and southeast of station 0 are described as follows:

Course	Bearing	Length	Description
0 - 1N.	N. 46° W.	15 ft.	First 9 feet consists of 2 bands of milky quartz separated by fragments of limestone. Quartz bands contain fair amount of cassiterite. Remaining 6 feet averages 12 inches in width and consists of micaceous vein material with high cassiterite content. Dip is vertical.

Course	Bearing	Length	Description
1N. - 2N.	N. 55° W.	4 ft. 4 in.	Micaceous material contain nodules or aggregates of cassiterite consistently to station 2N where vein pinches to a narrow seam of micaceous rock.
2N. - 3N.	N. 23° W.	15 ft. 8 in.	Vein is represented by narrow seam (1 to 2 inches wide) of altered rock, namely, chlorite, containing fine-grained tourmaline and scattered nodules of cassiterite.
3N. - 4N.	N. 20° W.	15 ft.	Vein content same as 2N-3N. Dip 2N. to 4N. is approximately 60° NE. Sta. 4N. is most northwesterly point at which vein can be positively identified.
0 - 1S.	N. 40° W.	12 ft.	Vein, 12-16 inches wide, consists largely of milky quartz containing some cassiterite and micaceous material containing cassiterite nodules. Some barren fragments of limestone are present in the vein. The dip is vertical.
1S. - 2S.	N. 80° W.	21 ft. 6 in.	Width of vein averages 12 inches. Vein matter is almost entirely micaceous rock, with nodules of cassiterite and some barren fragments of wall rock. Dip is vertical.
2S. - 3S.	N. 48° W.	22 ft. 6 in.	Vein material is similar to that between station 1S and 2S, but pinches to 1 inch in width. Vein contains fine-grained cassiterite where last seen 66 feet from station 0.

A number of pieces of both wall rock and cassiterite nodules show slickensides along the entire vein exposure.

WORK DONE BY THE BUREAU OF MINES

Trenching

Twenty one trenches were excavated, with a combined length of 3,690 feet, and 5,610 cubic yards of earth and rock were moved.

Trench 11 was 106 feet long, 9 feet wide, and 8 feet deep when excavation was stopped presumably about 4 feet above bedrock. Frozen ground was encountered at a depth of 5 feet.

Trench 10 was 119 feet long, 9 feet wide, and 6 feet deep. At a depth of 6 feet, bedrock was exposed by bulldozing in the north end of the trench. Near the south end, it was necessary to excavate for 1 foot or more of depth to reach bedrock. A trench 1 foot wide and 2 feet deep was dug 76 feet long. At this depth the bedrock was blocky, but no attempt was made to reach solid rock, as no metallic minerals were seen. A small fault separates a reddish and a dark-gray limestone near the north end of the trench. The reddish limestone encloses milky white quartz veins, one of which is 5 inches thick. The others are much thinner, and all contain a green mineral resembling serpentine or chlorite. The average strike of these stringers is N. 45° W., approximately that of the vein in K1A trench.

Trench 8 is situated at a point on the hill where overburden is excessive. Frozen muck was encountered at a depth of 9 feet. The trench is 231 feet long, 10 feet wide, and 13 feet deep.

Trench K1 is 140 feet long, 9 feet wide and 2 feet deep. A good grade of cassiterite float was found before bedrock was reached, and hand-trenching revealed a cassiterite-bearing quartz vein with a northwesterly trend.

Trench K2, roughly paralleling trench K1, is 135 feet long, 9 feet wide, and 4½ feet deep. The bedrock, a soft, disintegrated, ironstained granite, was found to be barren.

Trench K9, 60 feet southeast of K1, was attempted by hand in October 1943, but it was found nearly impossible to break through the crust. Excavation to a depth of 5 feet, a length of 150 feet, and a width of 10 feet was completed the following summer.

Trench K3, started in October 1943 and completed the following summer, was dug in an attempt to find the source of cassiterite float on the slope south of the North Star adit. The trench is 3 feet deep, 10 feet wide, and 150 feet long.

Trench 3 exposed bedrock at an average depth of 3½ feet, and over its entire length of 1,057 feet. Excavation was easy at the north end but was hampered by large boulders at the south end. Test pits sunk to 5 feet in depth showed no change in the composition of the bedrock material. Aside from one piece of cassiterite-bearing granite and some limonite a few feet from the north granite-limestone contact, no metallic minerals were seen.

Trench K10, situated adjacent to and at the northwest end of K1A, apparently reveals a spur off the main veins in K1A. This trench is 13 feet long by 6 feet wide and 3 feet deep.

Further attempts to discover lode cassiterite by trenching met little success. The following trenches were excavated:

Trench, feet	Length, feet	Width, feet	Depth, feet
K8	95	10	3.0
K5	65	10	3.5
K6	131	10	6.0
K11	150	10	2.5
K4	300	10	3.0
K7	200	10	3.0
K12	100	10	2.0
K13	30	10	0.5
K14	80	10	2.5
K15	60	10	1.2
K16	50	10	1.0

Drifting

Before sampling in the Bartell mine it was necessary to remove snow, ice, muck, and frozen gob from the North Star and Lowest adits. Snow had drifted into the North Star adit for 50 feet from the portal and filled the adit to a depth of 3 feet. At the entrance of the first winze room a mass of ice had formed, completely blocking the drift except for a 2- by 2-foot hole. A wedge of ice, 5 feet high at this point and tapering to the drift floor in 40 feet, had to be picked out in chunks and removed by means of a wheelbarrow.

The drift walls were heavily coated with a luxuriant growth of ice crystals, which extended about 300 feet along the drift. At a point 100 feet from the portal crystals in the form of thin hexagonal plates and hexagonal prisms growing perpendicular to the walls had attained diameters up to 6 inches. The crystals were brittle and easily removed by scraping with a shovel. Underneath, however, was a tenacious opaque film of ice 1 to 2 inches thick, which was removed from the walls by picking. Eight hundred cubic feet of ice was removed from this adit.

In the sublevel it was necessary to remove snow and ice in a similar manner. During the summer working season snow and ice crystals continued to re-form on the walls.

The portal of the Lowest adit was caved. After drifted snow was shoveled away, the adit was still blocked by muck and rocks, which were removed by using shovels and wheelbarrows. Behind this, for a distance unknown at the time, lay frozen, caved slide rock. As it was necessary to support the roof in some manner, 2- by 12-inch planks were used in forepoling through the slide rock. Progress was slow because of the frozen muck and large boulders. A hydraulic jack placed against the cap of an old set was used to advance the planks into the muck. The cave-in extended two sets, and behind it solid ice blocked the drift completely. An advance of 15 feet was made through the ice before an opening was found between the drift roof and the ice. This permitted air to circulate through the mine. The thickness of the ice diminished gradually from this point, but was still 2 feet thick 160 feet from the portal. Throughout the remainder of the mine the thickness of ice averaged 1 foot.

Mine rails were found on the drift floor ready for use. A mine car and 100 feet of mine rail were brought up from Goodwin Gulch and used in transporting ice from the mine.

Two shifts of two men each were employed in removing ice from the mine. On some days the advance would be 15 feet through ice 3 or 4 feet thick; on others, when the workmen were digging in a tough, rocky mass formed by fallen mud from the roof, the progress, in terms of measured feet, was negligible.

After ice had been removed the drift walls were cleaned in preparation for sampling.

Sampling

Sampling of the Bartell mine workings was started September 1, 1943, and completed that year. All surfaces were thoroughly cleaned where sampling was to be done, and the sample cutting was closely supervised by the foreman. In sampling mine workings, channels were cut 1 inch deep and 3 or 5 inches wide. One hundred four underground samples were collected, the location and analyses of which are shown on figures 5, 6, and 7.

Three trench samples were collected in 1943 and 19 in the summer of 1944. These were cut as channels 6 or 12 inches wide by 1 inch deep. Location and analyses for all except three are shown on figure 8. Samples 94 and 95 were collected from trench 3 at 340 feet and 155 feet, respectively, from the south end. Both were cut across the granite-limestone contact, and each contained less than 0.05 percent tin. Sample 115 was cut 40 feet north of the south end of trench K12 and contained 0.21 percent tin.

Eighteen samples were analyzed for tungsten, and all contained less than 0.05 percent WO_3.

The following table gives the analysis for CaF_2 and $CaCO_3$ of a group of Cape Mountain samples:

Sample No.	Analysis, Percent	
	CaF_2	$CaCO_3$
27	0.43	0.17
28	.43	.08
30	.53	.63
39	.49	< .05
40	.46	.17
43	.33	< .05
46	.46	.59
51B	1.86	.40
85	.20	10.20
86	.30	.21
89A	.30	5.56
89B	.26	.93
90C	.20	.13
91A	< .05	3.20
91B	.33	< .05
96	.36	8.72

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