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BERYLLIUM INVESTIGATIONS AT THE LOST RIVER MINE, SEWARD PENINSULA, ALASKA

by Robert V. Berryhill and John J. Mulligan with a section on petrography by Walter L. Gnagy

* open-file report

UNITED STATES DEPARTMENT OF THE INTERIOR

Stewart L. Udall, Secretary

BUREAU OF MINES

Frank C. Memmott, Acting Director

ILLUSTRATIONS

TABLES

TABLES (continued)

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by

Robert V. Berryhill[1/] and John J. Mulligan[2/]

ABSTRACT

Bureau of Mines sampling indicates that beryllium minerals, principally chrysoberyl, occur associated with fluorite in an extensive zone of altered limestones at the Lost River tin mine, Seward Peninsula, Alaska. The fluorite-beryllium deposits occur as veins and replacements along numerous intersecting faults and fractures and along the walls of dikes. The sampling did not delimit either the horizontal or vertical limits of deposition. A 500-foot by 1,000-foot area adjacent to Lost River mine was sampled because it contains many accessible altered limestone outcrops exposed during previous tin mining operations. The unweighted average grade of 124 vertical percussion-drill holes 5 feet deep in this area is 0.13 percent BeO. Diamond-drill core samples of altered limestone from various periods of drilling were collected and analyzed; 836 feet of altered limestone core drilled from the surface averages 0.12 percent BeO; 407 feet drilled from the 365 level in the Lost River mine (365 feet below the main entry) averages 0.13 percent BeO. The few available samples of the Cassiterite Dike average 0.07 percent BeO which may

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include some altered wall rock; the underlying granitic intrusive contains little more than traces of beryllium.

INTRODUCTION

The Bureau of Mines, in cooperation with the U.S. Geological Survey, is investigating the economic potential of beryllium deposits in the Lost River area, Seward Peninsula, Alaska (fig. 1). Beryllium never has been recovered commercially from deposits of the type found in this area. Therefore, a significant part of the Bureau's work will be metallurgical research. A necessary preliminary is sufficient sampling to determine if the size, grade, and general nature of the deposits warrant the extensive metallurgical research required to develop workable recovery methods. This report describes the original reconnaissance sampling which indicated that substantial amounts of beryllium occur in a complexly mineralized zone adjacent to the Lost River tin mine. Work on this deposit was stopped when the Geological Survey discovered other beryllium deposits in the Lost River valley that were apparently less complexly mineralized and higher in grade. The more recently discovered deposits and the results of metallurgical studies will be described in succeeding reports as the data becomes available.

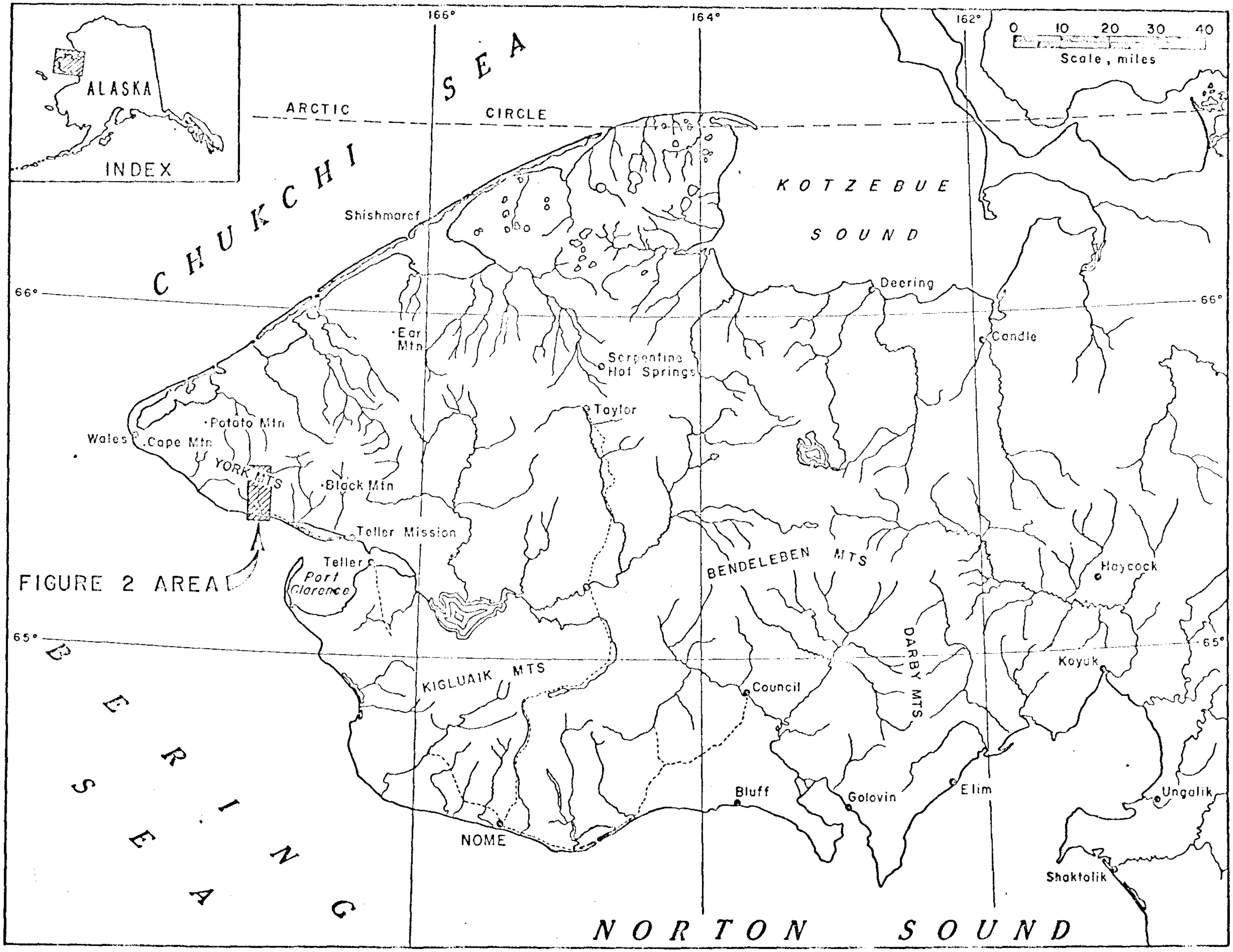

FIGURE I.- Index and Location Map, Seward Peninsula, Alaska.

ACKNOWLEDGMENTS

The Bureau of Mines Area VIII Mineral Resource Office, Juneau, Alaska initiated beryllium research in the Lost River area and coordinated the work with a Geological Survey mapping project in the same area. C. L. Sainsbury, U.S. Geological Survey geologist, assisted both in the field work and in the review of this report. Nuclear, chemical, petrographic, and spectroscopic analyses were made in the Bureau of Mines laboratory at Juneau. Routine spectrographic analyses and x-ray diffraction analyses were made in the Bureau of Mines laboratory, Area VII Mineral Resource Office, Albany, Oregon. The owners of Lost River tin mine, L. J. Grothe and T. Pearson, furnished housing for the Bureau of Mines personnel and materially assisted the field party.

The maps in this report have been adapted from various sources. Figure 1 is based on the Army Map Service 1:1,000,000 series map entitled Nome. Figure 2 is adapted from plate 1, U.S. Geological Survey Bulletin 1129. Figures 3 and 4 are adapted from figure 2 in Bureau of Mines Report of Investigations 3902. Elevation contours on figure 3 are about 60 feet lower than on recent maps. Figure 5 was adapted from figure 5 in Bureau of Mines Information Circular 7871.

LOCATION AND ACCESSIBILITY

Lost River is about 70 miles south of the Arctic Circle and 85 miles northwest of Nome, Alaska, near the western extremity of the Seward Peninsula and of the North American continent (fig. 1). The Lost River tin mine (latitude 65°31' N, longitude 167°09' W, altitude 300 to 400 feet) is on Cassiterite Creek, approximately 1 mile upstream from its junction with Lost River, and 6½ miles due north from the Bering Sea (fig. 2). A gravel-surfaced road extends from the mine to the beach. Access usually is by single-engine aircraft, based at Nome, Alaska. There are two airfields in Lost River valley; a 1,200-foot gravel runway near the junction of Cassiterite Creek with Lost River, and a 5,000-foot gravel runway near the beach west of the mouth of Lost River. The latter has been used by DC-3's and equivalent aircraft. It is advisable to check with local pilots on runway conditions before landing at either field. Heavy freight normally is landed from barges on the beach near the mouth of Lost River. The distance by sea from Lost River to Nome is approximately 95 statute miles.

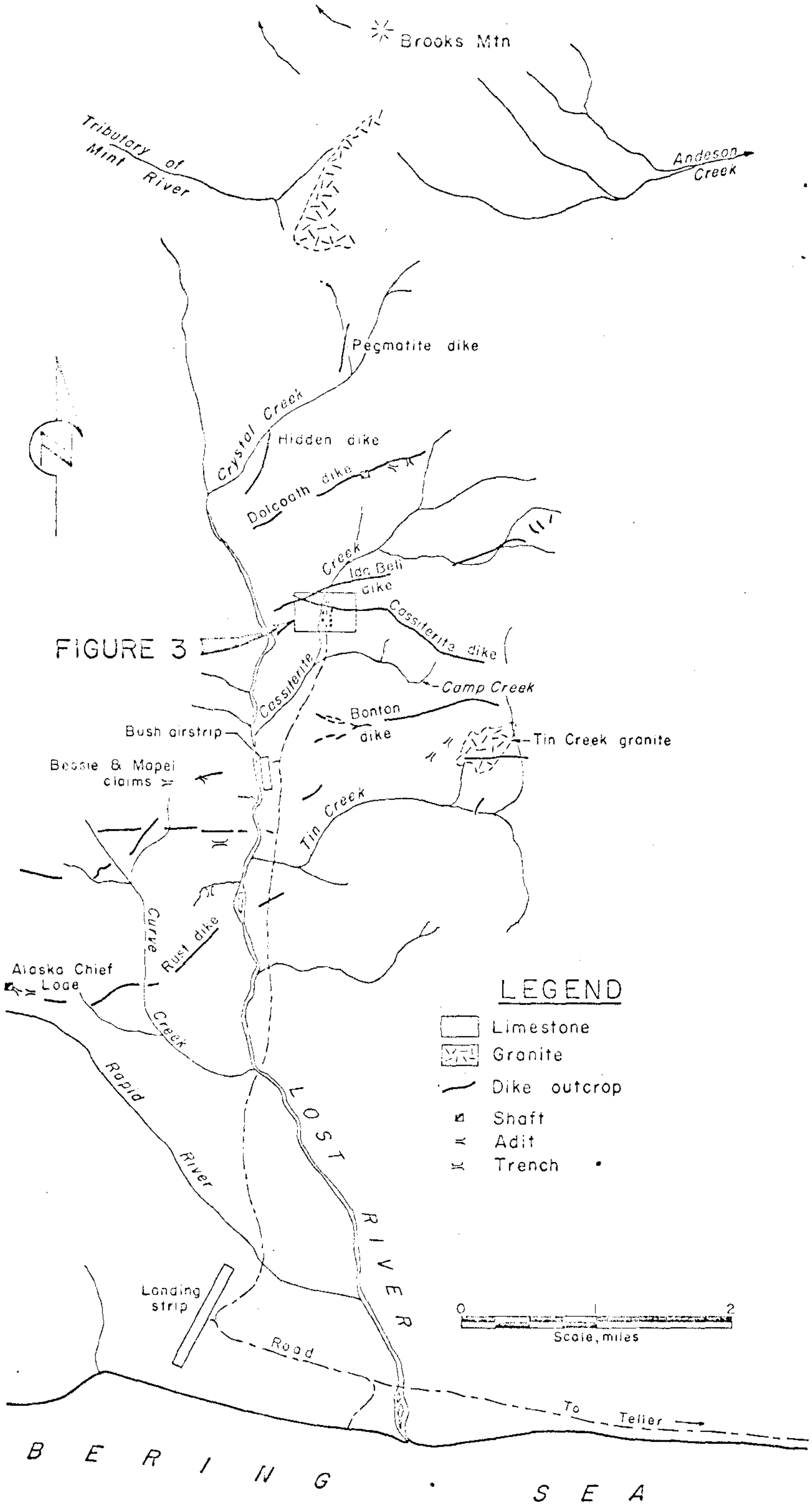

FIGURE 2.- Location Map, Lost River Area.

GENERAL GEOLOGY

The Lost River mine has been described in many Geological Survey and Bureau of Mines reports. The most comprehensive description is in Geological Survey Bulletin 1129, Geology of Lost River Mine Area, Alaska, by C. L. Sainsbury. This report was published in 1964 and can be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C.

WORK PERFORMED BY THE BUREAU OF MINES

Nature and Extent

Beryllium minerals were identified at the Lost River tin mine in 1942 by Geological Survey geologists working in cooperation with the Bureau of Mines. The identification was recorded in the Bureau report on this project (4).[3/] Subsequently, the similarity between the helvite-bearing "ribbon rock" from Iron Mountain, New Mexico and the "ribbon rock" from Tin Creek was noted by R. H. Jahns (5); tests of samples taken by Knopf (6) on Tin Creek showed that the Tin Creek ribbon rock contained beryllium in amounts comparable with the New Mexico ribbon rock. The significance of this occurrence was not realized for many years. The Bureau of Mines meanwhile detected beryllium at many other places in the western Seward Peninsula by spectrographic analyses of samples taken during a series of tin investigations (9, 10, 11, 12). Reports of beryllium occurrences in these publications drew attention to the western Seward Peninsula tin belt as a possible source of beryllium (15). Therefore, in September 1959, a Bureau of Mines 2-man crew obtained samples of surface exposures at the Lost River mine and some adjacent areas. Sample analyses indicated that appreciable and possibly valuable amounts of beryllium occur at the Lost River mine.

During the summer of 1960, the U.S. Geological Survey conducted regional geologic mapping in the Lost River area giving particular attention to beryllium. This resulted in the discovery of several beryllium

3/ Underlined numbers in parentheses refer to items in the bibliography at the end of this report.

deposits in the Lost River drainage basin (14, 15, 17), and delineation of geochemical anomalies elsewhere on the Seward Peninsula. A Bureau 2-man crew spent almost 3 weeks at the Lost River mine in July and August of 1960. A beryllium detecting field instrument was used to identify beryllium outcroppings and samples were obtained from the main haulage adit, Lost River mine. The year's work resulted in the recognition that chrysoberyl was an important mineral in the beryllium deposits at the Lost River mine. Visual guides for identifying Lost River-type beryllium deposits in place were recognized; this made it practical to search for other beryllium deposits without carrying cumbersome detecting devices.

In 1961, the Bureau of Mines sampled bedrock exposures at the Lost River mine in more detail. A 2-man crew drilled 163 percussion-drill holes and two vertical diamond-drill holes, and also checked all available samples from previous operations. Sampling and analytical methods, procedures, and results are given in detail in the following sections.

Beryllium Detection and Analyses

The Portable Beryllium Detection Device

The bombardment of any naturally occurring beryllium by gamma radiation of sufficient energy will remove a neutron from the nucleus of the beryllium atom; this principle is utilized in nuclear beryllium detection. The induced neutron reaction is proportional to the amount of beryllium in the material tested. The short range of neutron travel prevents detection of beryllium-bearing materials unless they are within a few inches of a detection device.

The component parts of beryllium detection devices are a gamma source (antimony 124), a detector, and a counter. The source emits gamma radiation which causes the beryllium in a sample to emit neutrons. The neutrons cause a reaction in the detector that is converted to electrical impulses which are recorded as a series of counts. The count is a measure of the beryllium content of material under test, but it is also a function of the instrument efficiency, distance from the sample, size of the sample, and strength of the gamma ray source. The short half-life of antimony 124 (60 days) necessitates daily instrument calibration.

Sample Analyses Methods

A portable beryllium detector was used during the field investigation and was also adapted for use in the laboratory. In the laboratory the instrument was mounted in a concrete enclosure, and a rotating pan mechanism was designed to place samples directly under the source and detector. The laboratory unit was used to make qualitative, semiquantitative, and quantitative analyses. All analyses were made by comparing counts obtained from a sample against counts from known standard samples. Standardized quantitative analytical procedures were developed after considering factors affecting the measurement of the neutron reaction. Reliability depends on the maintenance of constant conditions during the instrument calibration and sample testing, and on the accumulation of enough neutron counts for statistical accuracy.

Constant temperature was maintained by thermostatically controlled heating elements placed in the laboratory enclosure. Constant conditions were maintained between instrument calibration and assaying by preparing samples and standards to the same fineness and density in identical sample containers. Placement and spatial relationships were identical. Samples and standards were prepared in circular aluminum containers 9.1 cm in diameter by 3.7 cm deep containing 425 grams of sample. Occasional more dense samples were assayed by maintaining constant mass rather than constant geometry; circular wood spacers were added to the sample container and assays were completed with the container inverted.

The accumulation of enough count for statistical accuracy is a function of sample size, instrument efficiency, source strength, and the length of the counting period. The sample size and instrument efficiency were made constant as described. The source strength continually decreased at a constant rate and therefore decreased the neutron reactions intercepted. To offset this, the counting period was increased which nulified the decrease in total count obtained over a specific period. The counting error for any period of radioactive counting is considered to be double the square root of the total counts divided by the total count less the background count for the counting period. Longer counting periods become necessary as the grade of the sample decreases, but the time requirement for high accuracy in low-grade samples becomes impractical. Therefore, when assaying, counting periods were adjusted to obtain 25 percent theoretical reliability in samples containing 0.10 percent BeO; i.e., in a sample containing exactly 0.10 percent BeO, the count would be sufficiently long to result in an assay accurate within the limits of 0.075 percent to 0.125 percent.

Twelve samples were check assayed at Juneau chemically and at the Bureau of Mines Salt Lake City laboratory with a laboratory beryllium detector. Results (table 1) generally substantiate the assays made with the portable beryllium detection device at Juneau and indicate the range of fluctuation. Additional chemical checks made at Juneau are tabulated with other analyses data.

TABLE 1. - Check analyses, nuclear beryllium detection

Sample number	Juneau nuclear analyses BeO percent	Juneau chemical analyses BeO percent	Salt Lake nuclear analyses BeO percent
Percussion-drill hole 23	0.23	0.15	0.20
Percussion-drill hole 30	.24	.19	.19
Percussion-drill hole 76	.73	.78	.77
Percussion-drill hole 77	.39	.42	.47
Percussion-drill hole 91	.11	.09	.10
Percussion-drill hole 97	.26	.22	.23
Percussion-drill hole 144	.11	.08	.09
DMEA hole 4, 0 - 3.5	.22	.12	.13
DMEA hole 8, 8.0 - 12.7	.36	.28	.29
DMEA hole 8, 17.0 - 20.0	.18	.14	.17
DMEA hole 8, 35.0 - 39.8	.29	.20	.21
Diamond-drill hole 2, 3.2 - 6.7	.35	.26	.33
Arithmetical average	.29	.24	.27

Surface Sampling

A mantle of detritus 5 to 10 feet deep that covers most of the bedrock prevented systematic sampling of the outcrops in the Lost River mine area. Random exposures were found where building sites had been leveled by bulldozers, in old prospect trenches, along the creek banks, and along the ridge north of the Cassiterite Dike on the east side of Cassiterite Creek (fig. 3). Samples and specimens were obtained from such exposures by chip sampling and by percussion drilling.

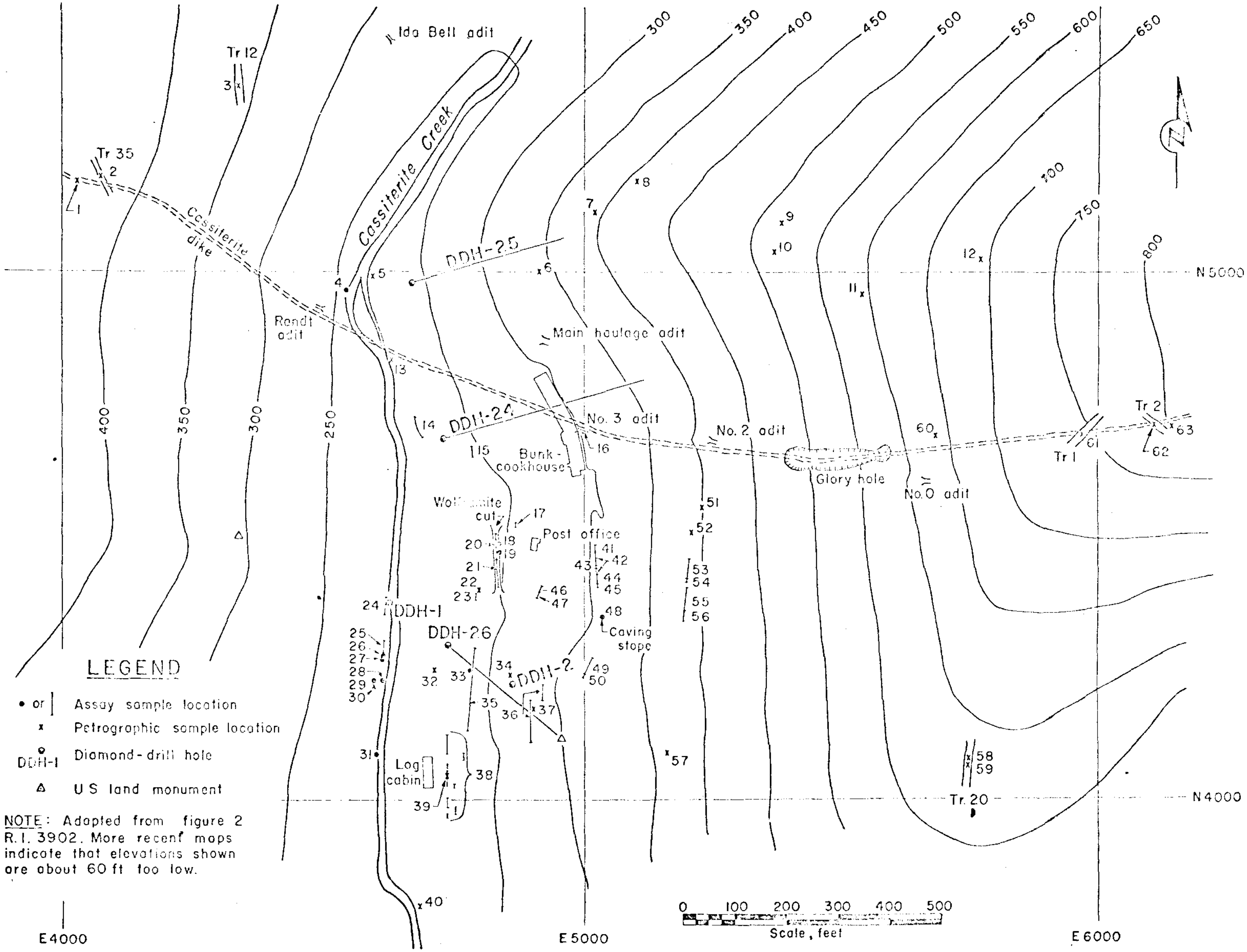

FIGURE 3.- Diamond-drill-hole and Sample Locations, Lost River Mine.

Chip Sampling

Continuous chip samples were cut from intensely mineralized zones; where mineralization appeared to have been less intense, walnut-size chips, taken at 1-foot intervals, were composited. Descriptions of specimens and samples with analyses data are in table 2; sample locations are shown on figure 3.

TABLE 2. - Chip sample descriptions and analyses data

Sample No.	Field engineer's description	BeO nuclear analyses percent	BeO chemical analyses percent	Other Analyses	
				Spectro-graphic	Petro-graphic
1	Dike specimen at junction of Cassiterite and Ida Bell Dikes.	-	-	X	-
2	Dike specimen from trench 35.....	-	-	-	X
3	Dike specimen from trench 12.....	-	-	-	X
4	Specimen of slightly altered limestone.	-	0.01	X	-
5	Specimen from Lost River mine dump.	-	-	-	X
6	Specimen of altered limestone....	-	-	X	X
7	Specimen of 1-inch veinlet in altered limestone.	-	-	-	X
8	Specimen of altered limestone....	-	-	-	X
9	.....do........................	-	-	-	X
10	Specimen of quartz pod..........	-	-	-	X
11	Specimen of gray-black altered limestone.	-	-	X	-
12	Limonite-stained float..........	-	-	-	X
13	Specimen of green slightly altered limestone.	-	-	-	X
14	Walnut-size chips of tactite taken at even 1-foot intervals across 47 feet.	0.09	.07	X	-
15	Walnut-size chips of tactite taken at even 1-foot intervals across 220 feet.	.14	.13	-	-
16	16.2-foot continuous chip sample at portal of adit No. 3.	.12	.07	X	-
17	4.2-foot continuous chip sample of tactite.	.37	.25	-	-
18	Selected specimen at sample 20...	-	.26	-	-
19	Selected specimen at sample 21...	-	.12	-	-
20	Walnut-size chips of tactite taken at even 1-foot intervals across 48.2 feet	.21	.16	X	-
21	Walnut-size chips of tactite taken at even 1-foot intervals across 40.0 feet.	.08	.07	-	-
22	Specimen of altered limestone....	-	-	-	X
23	11.0-foot continuous chip sample in highly altered and wolframite -enriched tactite.	.12	.10	X	-

TABLE 2. - Chip sample descriptions and analyses data (continued)

Sample No.	Field engineer's description	BeO nuclear analyses percent	BeO chemical analyses percent	Other Analyses Spectro-graphic	Other Analyses Petro-graphic
24	Walnut-size chips of tactite taken at even 1-foot intervals across 33.0 feet.	0.27	0.22	X	-
25	Walnut-size chips of tactite taken at even 1-foot intervals across 24.5 feet.	.06	.06	-	-
26	Specimen of creamy-white veinlets in altered limestone.	-	.46	-	X
27	Specimen, altered limestone walls of sample 26.	-	-	-	X
28	Specimen of creamy-white veinlet and altered limestone.	-	-	-	X
29	Selected specimen of tactite......	-	.41	-	-
30	Specimen of altered limestone.....	-	.30	-	X
31	Selected specimen of tactite......	-	.17	-	-
32	Specimen of altered limestone.....	-	.08	-	X
33	Selected specimen of fluorite veinlet at sample 36.	.57	.42	-	-
34	Select specimen of altered lime-stone, mostly green fluorite veinlet.	-	-	-	X
35	Walnut-size chips of tactite taken at even 1-foot intervals across 159 feet.	.09	.08	X	-
36	Walnut-size chips of tactite taken at even 1-foot intervals across 118.5 feet.	.18	.13	-	-
37	Chips of fluoritized veinlet 1 foot across at sample 36.	-	.07	-	X
38	Walnut-size chips of tactite taken at even 1-foot intervals composited from 109 feet total sample.	.10	.09	-	-
39	Chips of fluoritized veinlet 1 foot across at sample 38.	-	.18	X	X
40	Specimen of altered limestone, mostly green fluorite veinlet.	-	-	-	X
41	13.6-foot continuous chip sample, dike.	.02	.01	X	-
42	35.2-foot continuous chip sample of slightly altered limestone.	.08	.07	-	-
43	4.1-foot continuous chip sample, dike.	.02	.01	X	-
44	19.6-foot continuous chip sample of tactite.	.20	.15	X	X

TABLE 2. - Chip sample descriptions and analyses data (continued)

Sample No.	Field engineer's description	BeO nuclear analyses percent	BeO chemical analyses percent	Other Analyses Spectro-graphic	Other Analyses Petro-graphic
45[1/]	5.3-foot continuous chip sample in dike, not sampled to south contact because of overburden.	0.05	0.02	X	-
46	11.1-foot continuous chip sample of tactite.	.13	.11	X	-
47	Walnut-size chips of tactite taken at even 1-foot intervals across 9.0 feet.	.11	.09	-	X
48[2/]	Selected specimen of tactite......	-	.09	-	-
49	Walnut-size chips of tactite taken at even 1-foot intervals across 35.7 feet.	.13	.12	-	-
50	Walnut-size chips of tactite taken at even 1-foot intervals across 8.4 feet.	.20	.13	X	-
51	Specimen of slightly altered limestone.	-	-	-	X
52	.....do.........................	-	-	-	X
53	Walnut-size chips of tactite taken at even 1-foot intervals across 40.0 feet.	.03	.02	-	-
54	Walnut-size chips of tactite taken at even 1-foot intervals across 8.6 feet.	.03	.01	-	-
55	Walnut-size chips of tactite taken at even 1-foot intervals across 47.4 feet.	.01	.02	-	-
56	Walnut-size chips of tactite taken at even 1-foot intervals across 20.7 feet.	.01	.01	-	-
57	Specimen of slightly altered limestone from old shallow pit.	-	-	-	X
58	Specimen of altered dike (?) rock.	-	.05	X	-
59	Specimen of altered limestone.....	-	-	-	X
60	Specimen of altered limestone with mica stringer.	-	-	-	X
61	Specimen of slightly altered Cassiterite Dike.	-	.02	X	-
62	Specimen of slightly altered Cassiterite Dike with green cast.	-	Trace	X	-
63	Specimen of slightly altered Cassiterite Dike.	-	-	-	X

1/ Chemical assay, cesium = 0.14 percent.
2/ Chemical assay, cesium = 0.11 percent; thallium = 0.05 percent.

Percussion Drill Sampling

A gasoline-powered percussion drill was used to drill vertical holes 7/8-inch in diameter to an average depth of about 5 feet. Cuttings from the percussion-drill holes were recovered in a dust collector made by placing a canvas tarp over a No. 2 size galvanized washtub. The holes were collared to about 1/2-inch depth and a seal made from rubber tubing was placed over the collar. The tub and its dust confining tarp (with holes cut in the center of the tub bottom and tarp) were placed over the collared hole and the drill steel inserted through the tarp and tub; almost 100 percent of the cuttings were recovered. Sample locations are in figure 4; analyses data are in table 3.

All but one of the percussion-drill holes that contained 0.1 percent BeO or more occur in an area measuring 1,000 feet from north to south and 500 feet from east to west (fig. 4). The mathematical average grade of all holes (124) within this area is 0.13 percent BeO (table 3). Although this is not a sufficiently reliable figure on which to base a firm estimate of the ore reserves, it probably is indicative of the average grade of the fluoritized limestone.

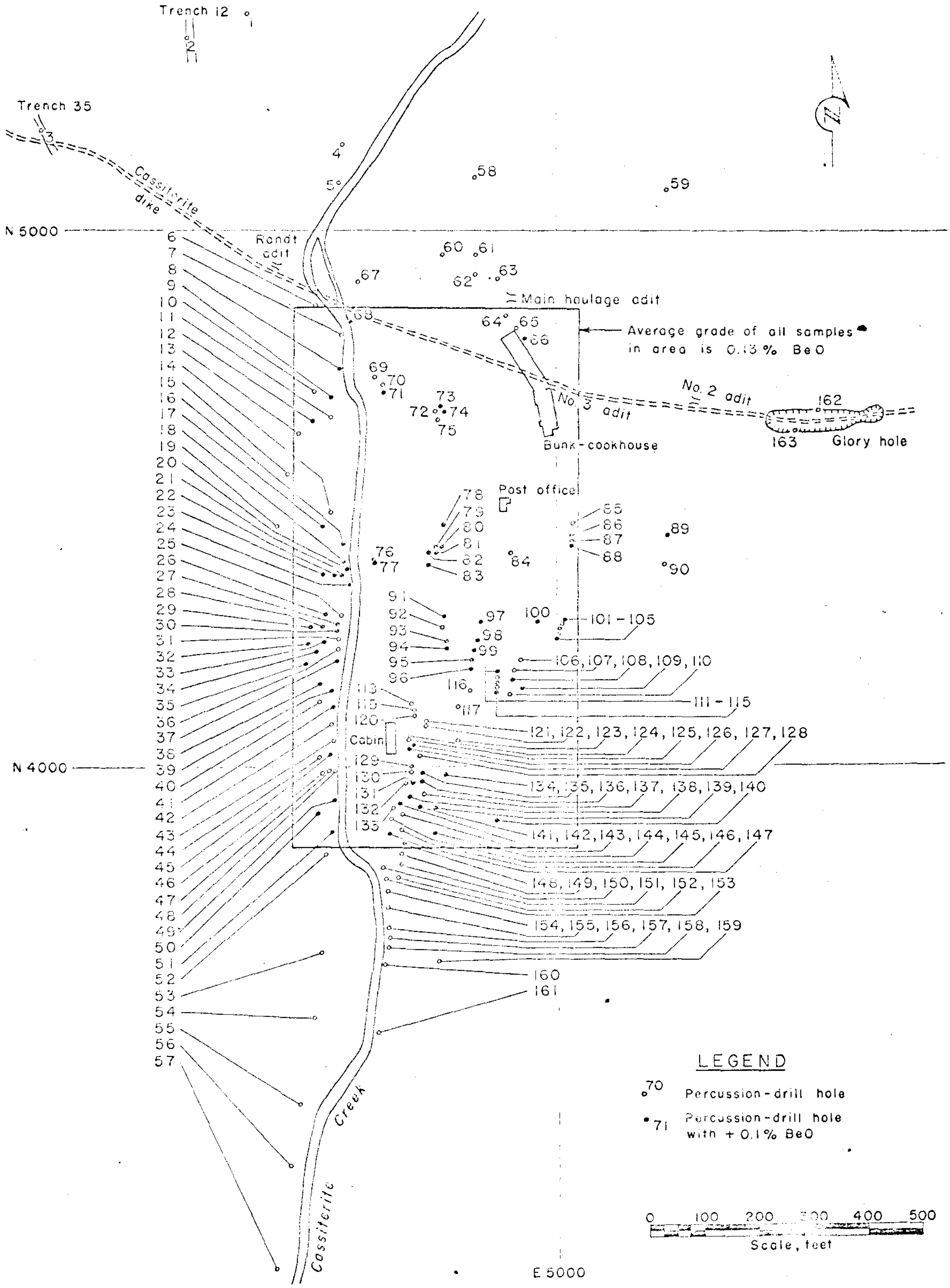

FIGURE 4.- Percussion-drill-hole Locations, Lost River Mine.

TABLE 3. - Percussion-drill hole sample data

Hole	Depth in feet	Percent BeO nuclear analyses	Hole	Depth in feet	Percent BeO nuclear analyses	Hole	Depth in feet	Percent BeO nuclear analyses
	Samples outside the area averaging 0.1 percent BeO							
1	5.4	0.03	56	1.2	0.03	151	5.7	0.09
2	5.4	.08	57	5.6	1/	152	5.5	.05
3	5.5	.02	58	5.4	.02	153	5.3	.09
4	5.5	.03	59	5.5	1/	154	5.5	.08
5	5.5	.03	60	5.4	.06	155	5.2	.02
6	2.9	.07	61	5.1	.04	156	4.7	.02
13	4.3	.05	62	4.9	.03	158	3.1	.03
15	5.4	.02	63	5.3	.03	159	5.2	.03
19	2.8	.05	67	5.5	.07	160	4.7	.04
52	5.4	.04	89	5.0	.16	161	5.7	.02
53	5.6	.05	90	5.6	.08	162	3.5	.04
54	5.6	.01	149	3.0	.03	163	5.8	1/
55	5.6	.01	150	5.5	.08			
	Samples within the area averaging over 0.1 percent BeO 2/							
7	2.5	.07	39	5.5	.11	81	5.5	.11
8	5.6	.10	40	5.7	.03	82	5.6	.28
9	5.4	.11	41	3.6	.24	83	5.7	.15
10	5.5	.03	42	5.4	.07	84	4.8	.12
11	5.4	.05	43	5.5	.08	85	5.5	.04
12	3.0	.13	44	5.6	.04	86	4.9	.31
14	5.5	.09	45	5.6	.14	87	5.5	.19
16	5.6	.11	46	5.5	.09	88	5.5	.18
17	5.8	.12	47	5.5	.10	91	5.5	.11
18	4.8	.20	48	2.7	.09	92	5.0	.03
20	5.3	.16	49	5.6	.10	93	5.4	.11
21	5.5	.12	50	5.6	.14	94	2.9	.21
22	5.5	.10	51	5.5	.10	95	5.5	.23
23	5.6	.23	64	5.8	.05	96	5.5	.13
24	2.9	.11	65	5.4	.05	97	5.5	.26
25	3.6	.08	66	1.8	.12	98	5.7	.21
26	5.6	.15	68	5.2	.14	99	5.5	.20
27	5.4	.11	69	5.6	.05	100	5.5	.15
28	5.7	.16	70	5.4	.03	101	3.0	.14
29	5.5	.21	71	5.3	.14	102	5.5	.06
30	5.3	.24	72	5.6	.09	103	5.5	.10
31	4.2	.09	73	5.6	.10	104	5.6	.18
32	5.5	.12	74	5.6	.15	105	5.5	.19
33	5.6	.19	75	5.5	.06	106	5.4	.09
34	5.6	.24	76	5.6	.73	107	5.5	.08
35	5.6	.19	77	5.6	.39	108	5.5	.19
36	3.0	.31	78	5.6	.23	109	5.6	.12
37	5.5	.15	79	5.5	.10	110	5.6	.07
38	5.6	.13	80	5.2	.14	111	5.5	.10

TABLE 3. - Percussion-drill hole sample data (continued)

Hole	Depth in feet	Percent BeO nuclear analyses	Hole	Depth in feet	Percent BeO nuclear analyses	Hole	Depth in feet	Percent BeO nuclear analyses
112	5.5	0.03	125	5.4	0.04	137	5.2	0.09
113	5.5	.12	126	5.6	.16	138	5.5	.15
114	3.8	.09	127	5.5	.10	139	3.0	.12
115	5.4	.10	128	5.5	.08	140	4.5	.10
116	5.5	.04	129	5.5	.38	141	3.5	.13
117	5.1	.04	130	5.5	.07	142	5.5	.13
118	5.5	.06	131	5.4	.13	143	5.5	.03
119	5.4	.05	132	5.5	.05	144	5.0	.11
120	5.5	.06	133	5.4	.04	145	5.5	.07
121	5.4	.06	134	5.6	.11	146	5.7	.09
122	5.4	.03	135	5.0	.12	147	5.5	.10
123	5.5	.08	136	5.5	.17	148	5.5	.10
124	5.5	.19						

1/ Nil.
2/ Average grade of the 124 holes in the area outlined (500 feet wide and 1,000 feet long, figure 4) = 0.13 percent BeO.

Diamond Drilling

Two vertical diamond-drill holes totaling 305.6 feet of EX- and SPO-size hole were drilled with a light, portable "packsack-type" drill. The total core recovery was 285.7 feet; no sludge was recovered. The cores were assayed for tin and beryllium. Drilling data and analyses results are in tables 4 and 5. Hole locations are shown on figure 3.

The weighted average grade of hole 1 was 206.6 feet of 0.13 percent BeO; the weighted average grade of hole 2 was 95.8 feet of 0.09 percent BeO. The analyses were weighted according to the length represented without regard to core recovery.

TABLE 4. - Diamond-drill hole logs and analyses, hole 1

Location: Lat. 4868 N, Dep. 4621 E
Elevation of collar: 216 feet
Depth: 206.6 feet
Bearing: 0°
Inclination: 90°

Date begun: July 27, 1961
Date finished: August 9, 1961
Core sizes: SPO to 7.2 feet
EX to 174.1 feet
SPO to 206.6 feet

Footage			Core recovery percent	Sn, percent	BeO nuclear analyses, percent 1/	Project engineer's log and description
From	To	Distance				
0.0	6.2	6.2	86	0.16	0.13	0 to 10.5 feet, dark gray metamorphosed limestone with green fluorite and occasional white silicate stringers as follows: 7-inch fluorite-silicate stringer at 4.7 feet; 5-inch same at 5.7 feet; 1-inch same at 6.0 feet; 6-inch same with trace of pyrite at 7.2 feet; 2-inch same with trace of pyrite at 9.8 feet.
6.2	9.8	3.6	97	.16	.11	
9.8	14.9	5.1	100	.15	.21	
14.9	19.7	4.8	100	.07	.13	10.5 to 40.0 feet, gray metamorphosed limestone with occasional randomly oriented green fluorite and white silicate stringers; white silicates more common than at top of hole. 1-inch green fluorite-silicate stringer at 27.8 feet; 1-inch same at 28.8 feet.
19.7	24.5	4.8	100	.14	.28	
24.5	27.7	3.2	97	.07	.11	
27.7	32.5	4.8	100	.09	.08	
32.5	37.6	5.1	100	.04	.29	
37.6	42.5	4.9	100	.06	.11	
42.5	47.4	4.9	96	.10	.13	40.0 to 50.0 feet, dark gray metamorphosed limestone with fluorite-silicate stringers common, few white silicate stringers and few sulfides associated with fluorite-silicates. 3-inch fluorite-silicate stringer at 40.0 feet; 1-inch same at 41.3 feet; 2-inch same at 43.7 feet; 2-inch same at 45.0 feet; 3-inch same at 45.5 feet; 7-inch same at 48.5 feet.
47.4	52.4	5.0	100	.22	.14	
52.4	55.6	3.2	96	.07	.11	50.0 to 71.5 feet, light gray metamorphosed limestone with white silicate stringers to 1/4-inch more common, traces of pyrite. 2-inch fluorite-silicate stringer at 59.5 feet.
55.6	60.6	5.0	100	.21	.15	
60.6	65.7	5.1	98	.04	.10	
65.7	70.7	5.0	100	.03	.09	
70.7	77.5	6.8	82	.19	.20	
77.5	82.5	5.0	100	.19	.13	71.5 to 80.0 feet, gray metamorphosed limestone with occasional fluorite-silicate stringers, few white

TABLE 4. - Diamond-drill hole logs and analyses, hole 1 (continued)

Footage			Core recovery percent	Sn, percent	BeO nuclear analyses, percent 1/	Project engineer's log and description
From	To	Distance				
						stringers. 4-inch fluorite-silicate stringer at 71.5 feet (with trace of pyrite); 8-inch same at 72.8 feet; 10-inch same at 75.0 feet; 2-inch same at 77.3 feet; 4-inch same at 79.0 feet; 3-inch same at 80.0 feet.
82.5	87.7	5.2	90	0.04	0.23	80.0 to 107.5 feet, light gray metamorphosed limestone with occasional fluorite-silicate and white silicate stringers.
87.7	92.5	4.8	98	.06	.30	
92.5	97.5	5.0	98	.04	.13	
97.5	100.1	2.6	100	.03	.08	
100.1	104.7	4.6	87	.02	.10	
104.7	108.1	3.4	97	.04	.06	107.5 to 111.0 feet, dark gray metamorphosed limestone with many 1/8- to 1/4-inch randomly oriented fluorite-silicate stringers.
108.1	113.0	4.9	98	.04	.01	
113.0	118.1	5.1	98	.02	.07	111.0 to 135.0 feet, light gray metamorphosed limestone occasionally with a blue cast; 1-inch fluorite-silicate stringer at 121.0 feet; 1-inch white silicate stringer at 129.0 feet; 1-inch fluorite-silicate stringer at 132.5 feet.
118.1	125.1	7.0	97	.06	.06	
125.1	130.1	5.0	100	.02	.08	
130.1	134.6	4.5	85	.08	.13	
134.6	137.7	3.1	68	.03	.07	
137.7	142.1	4.4	96	.07	.10	135.0 to 206.6 feet, light gray limestone with occasional fluorite-silicate stringer and fewer white silicate stringers. 2-inch banded green and white veinlet at 145.8 feet; 2-inch fluorite-silicate veinlet at 155.0 feet; 1-inch same at 163.5 feet; 4-inch same at 172.6 feet. No iron oxide observed in core. No radioactivity. Occasional fluorescent speck of powellite and/or scheelite detected throughout length of core.
142.1	144.7	2.6	92	.05	.04	
144.7	148.9	4.2	64	.03	.13	
148.9	154.1	5.2	98	.03	.03	
154.1	159.1	5.0	100	.02	.08	
159.1	164.0	4.9	100	.03	.12	
164.0	169.1	5.1	98	.02	.05	
169.1	174.1	5.0	100	.02	.10	
174.1	181.9	7.8	100	.02	.10	
181.9	187.5	5.6	100	.02	.18	
187.5	196.1	8.6	100	.02	.17	
196.1	201.4	5.3	96	.01	.05	
201.4	206.6	5.2	96	.02	.16	

1/ Total footage assayed, 0 to 206.6 = 206.6 feet
Weighted average grade = 0.13 percent BeO.

TABLE 5. - Diamond-drill hole logs and analyses, hole 2

Location: Lat. 4215 N, Dep. 4859 E
Elevation of collar: 252 feet
Depth: 96.9 feet
Bearing: 0°
Inclination: 90°

Date begun: September 1, 1961
Date finished: September 6, 1961
Core sizes: SPO to 96.9 feet

Footage			Core recovery percent	Sn, per-cent	BeO nuclear analyses, percent 1/	Project engineer's log and description
From	To	Dis-tance				
0.0	1.1	1.1	0	2/	2/	0.0 to 22.7 feet, light gray metamorphosed limestone with occasional gray-green silicate stringers all randomly oriented. No stringer more than 3/8-inch.
1.1	3.2	2.1	57	0.10	0.16	
3.2	6.7	3.5	86	.10	.35	
6.7	10.7	4.0	68	.02	.08	
10.7	12.7	2.0	100	.05	.10	
12.7	16.2	3.5	100	.02	.09	
16.2	19.8	3.6	86	.03	.06	
19.8	22.7	2.9	100	3/	.15	
22.7	26.9	4.2	86	.08	.11	22.7 to 36.8 feet, same as above, but limestone darker gray, a few more fluorite-silicate stringers. 1/4-inch iron-stained vug at 36.5 feet. Yellow-stained limestone with small limonite seams 35.8 to 36.8 feet.
26.9	28.8	1.9	100	.02	.02	
28.8	31.4	2.6	96	.02	.03	
31.4	36.8	5.4	83	.07	.11	
36.8	43.5	6.7	19	4/	3/	36.8 to 43.5 feet, vuggy iron-oxide-stained limestone. Some crystalline calcite. Traces of pyrite and cassiterite at 36.8 to 37.0 feet.
43.5	47.5	4.0	75	4/	3/	43.5 to 45.0 feet, vuggy, altered limestone with trace of pyrite, wolframite (?), and cassiterite. 45.0 to 47.5 feet, iron-oxide-stained and seamed metamorphosed limestone with few sulfides.
47.5	48.8	1.3	77	.44	.02	47.5 to 48.8 feet, soft, altered iron-oxide-stained limestone with traces of sulfides.
48.8	52.8	4.0	87	.09	3/	48.8 to 52.8 feet, same as above with pyrite, cassiterite(?) and wolframite (?).
52.8	59.8	7.0	87	.04	.06	52.8 to 54.0 feet, less iron-oxide staining and less pyrite. No cassiterite observed.
59.8	66.8	7.0	98	.09	.06	54.0 to 96.9 feet, gray metamorphosed limestone with gray and green fluoritic silicate stringers randomly
66.8	77.1	10.3	94	.07	.02	
77.1	82.9	5.8	91	.02	.23	

TABLE 5. - Diamond-drill hole logs and analyses, hole 2 (continued)

Footage			Core recovery percent	Sn, percent	BeO nuclear analyses, percent 1/	Project engineer's log and description
From	To	Distance				
82.9	88.3	5.4	98	0.02	0.08	oriented; 1-inch fluorite-silicate stringer at 69.7 feet; 2-inch white silicate stringer at 79.3 feet; 1/2-inch white silicate stringer at 92.4 feet.
88.3	96.9	8.6	98	.03	.16	

1/ Total footage assayed, 0.0 to 96.9 = 95.8 feet
Weighted average grade = 0.09 percent BeO.

2/ No assay.

3/ Trace.

4/ Composite sample 36.8 to 47.5, Sn = 0.20 percent; WO_3 = 0.14 percent.

Old Diamond-Drill Core

Part of the diamond-drill core from holes DDH-24, -25, and -26 (fig. 3), drilled by the Bureau of Mines during World War II (11), was recovered and analyzed for BeO. Diamond-drill core from the World War II drilling had been stored in abandoned mine buildings. Upon reactivation of the mine in 1951, the core boxes had been removed from the buildings and dumped together in a pile. Most of the core had been spilled or picked from the boxes and weathering had removed most markings. The core that was analyzed came from 13 boxes that were positively identified. Abridgements of the original logs describe the core that was recovered. Core logs and beryllium analyses are in tables 6 through 8. Holes are shown on figure 3.

TABLE 6. - Diamond-drill hole logs and analyses, hole 24

Location:1/ Lat. 4689, Dep. 4734
Elevation of collar: 239 feet
Depth: 518 feet
Bearing: N 74° E
Inclination: -40°

Date begun: July 30, 1944
Date finished: August 7, 1944
Core sizes: BX to 13 feet
AX to 79 feet
EX to 518 feet

Footage			Core recovery, percent	BeO nuclear analyses, percent 2/	Project engineer's log and description
From	To	Distance			
0.0	9.0	9.0	78	0.02	0 to 31.0 feet, gray limestone with minor fluorite and silicate seams.
9.0	13.0	4.0	67	.04	
13.0	17.0	4.0	67	.04	
17.0	27.0	10.0	75	3/	
27.0	37.0	10.0	66	4/	31.0 to 36.0 feet, light brown iron-oxide-stained limestone breccia. 36.0 to 36.5 feet, light gray limestone.
37.0	42.0	5.0	100	.04	36.5 to 43.0 feet, brown-stained green fluorite-silicate breccia.
42.0	47.0	5.0	100	.04	43.0 to 44.0 feet, gray limestone with minor green stringers, brecciated. 44.0 to 45.0 feet, brecciated green fluorite-silicate stringer.
47.0	53.0	6.0	78	.02	45.0 to 82.0 feet, gray limestone with minor green seams and green silicate stringers as follows: 6-inch at 58 feet; 12-inch oxidized at 63 feet; 6-inch at 65 feet; 12-inch at 67.5 feet; 8-inch at 69 feet.
53.0	58.0	5.0	100	.02	
58.0	63.0	5.0	100	.07	
63.0	69.0	6.0	97	.08	
69.0	79.0	10.0	91	.04	
79.0	130.0	51.0	0	4/	
130.0	142.0	12.0	46	.11	129.0 to 131.0 feet, brown-stained green limestone contact rock with garnet, fluorite, and chlorite. 131.0 to 141.0 feet, brown-stained altered kaolinized feldspar porphyry, black oxide stains, sparse wolframite(?) at plus or minus 40° angle with hole.
142.0	154.0	12.0	46	.10	141.0 to 148.0 feet, gray fluoritized limestone. Crystalline calcite stringer at 148 feet.
154.0	166.0	12.0	63	.11	148.0 to 157.0 feet, brown oxide-stained, porous, crumbly, kaolinized feldspar dike with fluorite, wolframite, calcite, black oxide coatings.
166.0	172.0	6.0	85	.23	157.0 to 258.0 feet, 6 inches of fluoritized contact rock, rest is gray, crystalline limestone with green fluorite
172.0	178.0	6.0	83	.08	
178.0	184.0	6.0	83	.20	

TABLE 6. - Diamond-drill hole logs and analyses, hole 24 (continued)

Footage			Core recovery, percent	BeO nuclear analyses, percent2/	Project engineer's log and description
From	To	Distance			
184.0	190.0	6.0	83	0.13	stringers as follows: 1/2-inch with wolframite at 160.5 feet; with pyrite and wolframite(?) at 164.5 to 166 feet; 8-inch at 175 feet; 12-inch at 176 feet; 24-inch at 181 feet; 6-inch at 184 feet; 18-inch with pyrite at 189 feet; limestone is coarsely crystalline from 184 to 203 feet; 6-inch at 253 feet.
190.0	196.0	6.0	88	.08	
196.0	202.0	6.0	85	.16	
202.0	208.0	6.0	85	.23	
208.0	213.0	5.0	100	.11	
213.0	219.0	6.0	85	.24	
219.0	225.0	6.0	86	.23	
225.0	230.0	5.0	96	.23	
230.0	236.0	6.0	80	.10	
236.0	241.0	5.0	94	.11	
241.0	251.0	10.0	60	.22	
251.0	256.0	5.0	100	.24	
256.0	261.0	5.0	73	.30	258.0 to 258.5 feet, fluorite mica stringer with cassiterite(?), green stain on white mica. 258.5 to 260.0 feet, white fluorite.
261.0	267.0	6.0	83	.06	260.0 to 310.0 feet and 402.0 to 518.0 feet gray crystalline limestone with minor green stringers as follows: 2-inch at 266.5 feet; 12-inch at 302 feet; 6-inch at 305 feet; 2-inch at 402 feet; 2-inch at 404 feet; 6-inch at 407 feet; 6 inches sand at 419 feet; 2-inch at 459.5 feet; 14-inch at 481 feet with pyrite and wolframite; 6-inch at 497 feet; 6-inch at 502.5 feet; 12-inch at 504 feet; 6-inch at 516 feet; from 455 to bottom of hole limestone becomes more coarsely crystalline.
267.0	273.0	6.0	85	.08	
273.0	279.0	6.0	81	.15	
279.0	285.0	6.0	81	.09	
285.0	292.0	7.0	70	.18	
292.0	298.0	6.0	71	.04	
298.0	304.0	6.0	43	.05	
304.0	310.0	6.0	85	.11	
310.0	402.0	92.0	0	4/	
402.0	408.0	6.0	71	.17	
408.0	414.0	6.0	83	.09	
414.0	419.0	5.0	42	.03	
419.0	425.0	6.0	73	.05	
425.0	430.0	5.0	60	.08	
430.0	436.0	6.0	81	.01	
436.0	442.0	6.0	81	.25	
442.0	447.0	5.0	100	.06	
447.0	453.0	6.0	60	.06	
453.0	458.0	5.0	100	.12	
458.0	463.0	5.0	74	.07	
463.0	468.0	5.0	100	.06	
468.0	473.0	5.0	100	.06	
473.0	479.0	6.0	85	.07	
479.0	485.0	6.0	85	.13	
485.0	490.0	5.0	98	.06	
490.0	495.0	5.0	80	.07	

TABLE 6. - Diamond-drill hole logs and analyses, hole 24 (continued)

Footage			Core recovery, percent	BeO nuclear analyses, percent 2/	Project engineer's log and description
From	To	Distance			
495.0	500.0	5.0	98	0.07	
500.0	508.0	8.0	90	.14	
508.0	513.0	5.0	46	.09	
513.0	518.0	5.0	26	.05	

1/ Coordinates converted to system used during DMEA explorations.
2/ Total footage assayed, 0 to 70.0 = 69.0 feet
Weighted average grade = 0.03 percent BeO.
Total footage assayed, 130.0 to 310.0 = 180.0 feet
Weighted average grade = 0.14 percent BeO.
Total footage assayed, 402.0 to 518.0 = 116.0 feet
Weighted average grade = 0.09 percent BeO.
3/ Trace.
4/ Core missing.

TABLE 7. - Diamond-drill hole logs and analyses, hole 25

Location:[1/] Lat. 4984, Dep. 7675
Elevation of collar: 241 feet
Depth: 401 feet
Bearing: N 74° E
Inclination: -40°

Date begun: August 8, 1944
Date finished: August 11, 1944
Core sizes: BX to 16 feet
AX to 222 feet
EX to 401 feet

Footage			Core recovery, percent	BeO nuclear analyses, percent[2/]	Project engineer's log and description
From	To	Distance			
0.0	365.0	365.0	90	[3/]	0 to 401.0 feet, gray limestone with minor green fluorite-silicate.
365.0	370.0	5.0	78	0.19	
370.0	375.0	5.0	100	.18	
375.0	380.0	5.0	72	.14	
380.0	385.0	5.0	88	.14	
385.0	391.0	6.0	85	.16	
391.0	396.0	5.0	96	.12	
396.0	401.0	5.0	98	.27	

1/ Coordinates converted to system used during DMEA explorations.
2/ Total footage assayed, 365.0 to 401.0 = 36.0 feet
Weighted average grade = 0.17 percent BeO.
3/ Core missing.

TABLE 8. - Diamond-drill hole logs and analyses, hole 26

Location:[1] Lat. 4295, Dep. 4742
Elevation of collar: 220.5 feet
Depth: 354 feet
Bearing: S 51° E
Inclination: -40°

Date begun: August 21, 1944
Date finished: September 1, 1944
Core sizes: BX to 20 feet
AX to 255 feet
EX to 354 feet

Footage From	Footage To	Footage Distance	Core recovery, percent	WO_3 nuclear analyses, percent[2]	Project engineer's log and description
0.0	23.0	23.0	0	[3]	0 to 10.0 feet, fluoritic metamorphosed limestone.
23.0	33.0	10.0	51	0.14	10.0 to 38.5 feet, light brown oxide-stained
33.0	39.0	6.0	65	.10	gray fluoritic metamorphosed limestone with numerous gray and green silicate and fluorite stringers.
39.0	43.0	4.0	95	.12	38.5 to 53.0 feet, gray fluoritic limestone
43.0	52.0	9.0	67	.15	and green metamorphosed limestone with garnet and other silicate minerals.
52.0	58.0	6.0	58	.12	53.0 to 58.5 feet, limestone with green
58.0	69.0	11.0	92	.12	fluorite-silicate stringers. 58.5 to 64.0 feet, fluoritized metamorphosed limestone with coarse mica veins, pyrite, and wolframite; oxide-coated casts; kaolinized mica dike at 62 to 62.5 feet. 64.0 to 69.0 feet, gray limestone with seams of pyritic green silicates.
69.0	75.0	6.0	85	.22	69.0 to 69.5 feet, brown oxidized dike(?)--stringer with mica, kaolin, fluorite.
75.0	80.0	5.0	88	.24	69.5 to 81.0 feet, gray limestone with green silicate and gray fluorite stringers containing pyrite and black tourmaline as follows: 12-inch at 69.5 feet; 3-inch at 71 feet; 12-inch at 72.5 feet; 4-inch at 75 feet; 3-inch at 76 feet; 6-inch at 79.5 feet.
80.0	85.0	5.0	96	.08	81.0 to 82.5 feet, green chloritic garnetized fluoritized metamorphosed limestone with oxide coated open casts; pyritic.
85.0	95.0	10.0	56	.03	82.5 to 96.0 feet, limestone and gray fluoritic limestone with green and gray silicate stringers.
95.0	101.0	6.0	51	.10	96.0 to 111.0 feet, gray limestone with
101.0	106.0	5.0	100	.15	random green seams; patches of garnet
106.0	111.0	5.0	100	.12	and wolframite.

TABLE 8. - Diamond-drill hole logs and analyses, hole 26 (continued)

Footage			Core recovery, percent	BeO nuclear analyses, percent[2/]	Project engineer's log and description
From	To	Distance			
111.0	116.0	5.0	96	0.14	111.0 to 113.0 feet, banded fluorite stringers and limestone seams in limestone.
116.0	121.0	5.0	94	.14	113.0 to 186.0 feet, gray limestone; 5 inches abundant pyrite at 136 feet.
121.0	126.0	5.0	100	.33	
126.0	131.0	5.0	100	.25	
131.0	136.0	5.0	100	.37	
136.0	141.0	5.0	84	.10	
141.0	145.0	4.0	92	.05	
145.0	150.0	5.0	100	.11	
150.0	155.0	5.0	100	.17	
155.0	354.0	199.0	0	3/	186.0 to 354.0 feet, altered limestone and granite.

1/ Coordinates converted to system used during DMEA explorations.

2/ Total footage assayed 23.0 to 155.0 = 132.0 feet
Weighted average grade = 0.15 percent BeO.

3/ Core missing.

Underground Sampling

The main haulage level of the Lost River tin mine (fig. 5) was accessible and was sampled during this investigation. The lower levels were not accessible, but samples on file at the Bureau laboratory in Juneau were tested for beryllium.

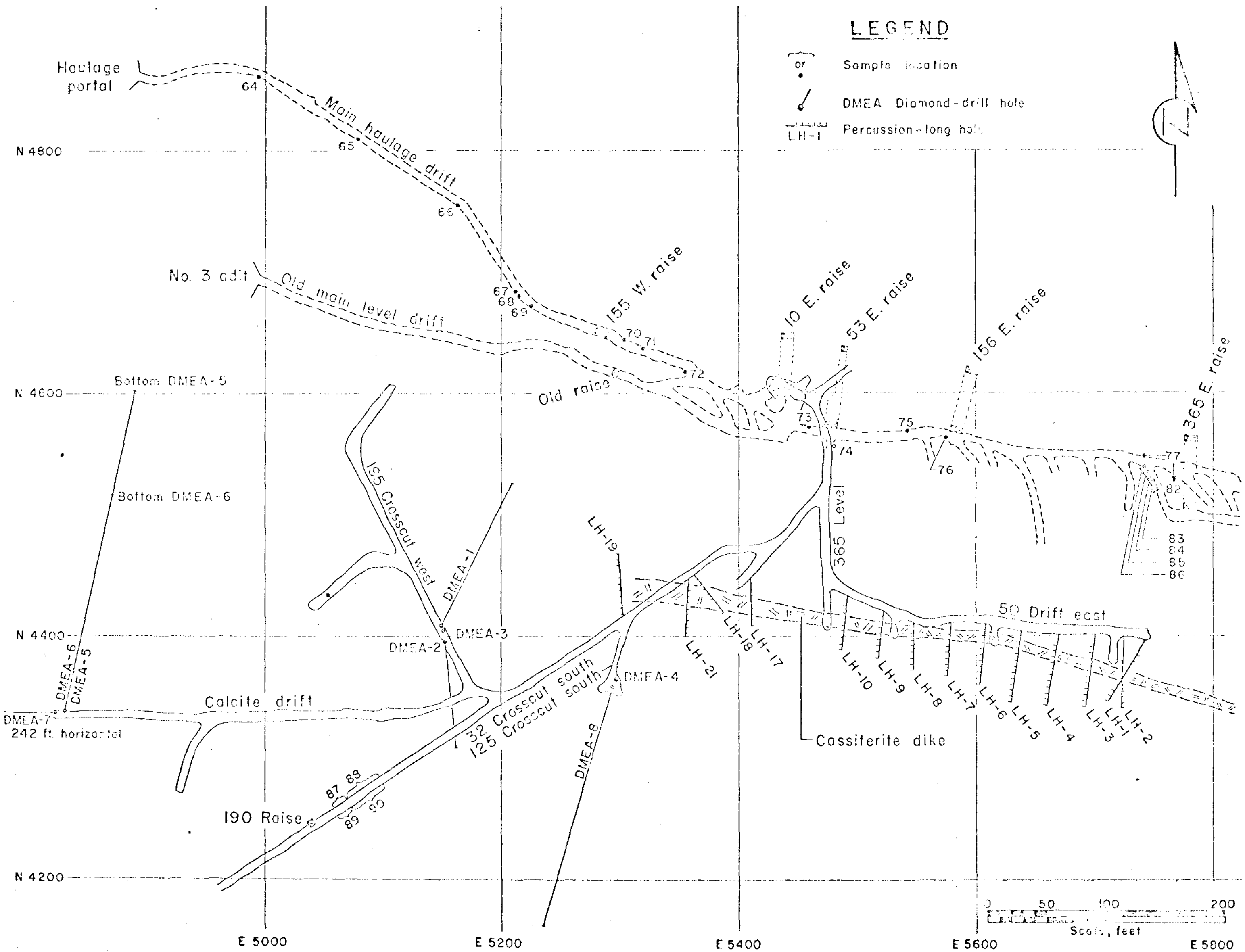

FIGURE 5.- Drill-hole and Sample Locations, Main Haulage and 365 Level, Lost River Mine.

Main Haulage Level

Sample descriptions and analyses data for samples taken on the main haulage level are in table 9. Sample locations are on figure 5.

TABLE 9. - Main haulage level, chip sample descriptions and analyses

Sample No.	Engineer's field description	Percent BeO nuclear analyses	Other analyses Petro-graphic
64	Specimen of tactite 100 feet from portal..............	0.14	-
65	Specimen of tactite 200 feet from portal..............	.11	-
66	Specimen of tactite 300 feet from portal..............	.05	-
67	Selected specimens at mineralized gouge zone 385 feet from portal.	.01	-
68	Specimen of tactite at sample 67......................	.05	-
69	Specimen of tactite 400 feet from portal..............	.06	-
70	Specimen of altered limestone 20 feet east of 155 W raise.	1/	X
71	Specimen of tactite 500 feet from portal..............	.06	-
72	Specimen of tactite at crosscut.......................	.02	-
73	Limestone fragments and fines collected from draw point	1/	X
74	Specimen of tactite opposite raise....................	.06	-
75	Limestone fragments and fines collected from draw point	1/	X
76	Specimen of tactite opposite raise....................	.03	-
77	Selected specimen of more altered tactite 37 feet from Cassiterite Dike.	.02	-
78	Selected specimen of more altered tactite 21 feet from Cassiterite Dike.	.05	-
79	Selected specimen of more altered tactite 15 feet from Cassiterite Dike.	.03	-
80	Selected specimen of more altered tactite 6.5 feet from Cassiterite Dike.	.10	-
81	Selected specimen of more altered tactite 3.5 feet from Cassiterite Dike.	.18	-
82	Selected specimen of more altered tactite at contact with Cassiterite Dike.	.10	-
83	Fist-size chips of tactite taken at 1-foot intervals from Cassiterite Dike contact to 6 feet in footwall.	.08	-
84	Fist-size chips of tactite taken at 1-foot intervals from 7 to 12 feet in footwall.	.06	-
85	Fist-size chips of tactite taken at 1-foot intervals from 13 to 18 feet in footwall.	.04	-
86	Fist-size chips of tactite taken at 1-foot intervals from 19 to 23 feet in footwall.	.02	-

1/ No assay. Chemical assay, sample 70, 0.11 percent BeO; chemical assay, sample 73, 0.10 percent BeO.

365 Level

The 365 level is 365 feet below the main haulage adit, Lost River mine (fig. 5). Splits of diamond-drill core, percussion-drill samples, and mill test samples obtained on the 365 level during a DMEA investigation in 1955 were scanned in the Bureau laboratory with the beryllium detection device. Beryllium was detected in most of the limestone samples and occasionally noted in samples of the granitic intrusives. Therefore, all limestone samples and 438.8 feet of granite samples were assayed for beryllium.

Diamond-drill holes DMEA-1 through DMEA-8 are described in tables 10 through 16. Data on DMEA-5 has been omitted because no beryllium was found in this hole. Data from percussion long-holes are in table 17. Mill-test sample analyses are in table 18. All sample locations are on figure 5.

TABLE 10. - Diamond-drill hole logs and analyses, DMEA hole 1

Location: 195 X-cut west
Station: 314+22 feet
Depth: 187 feet
Bearing: N 25° E
Inclination: -45°

Date begun: June 8, 1955
Date finished: June 22, 1955
Core sizes: BX to 6 feet
AX to 187 feet

Footage			Core recovery, percent	BeO nuclear analyses, percent 1/	Project engineer's log and description
From	To	Distance			
0.0	5.0	5.0	95	0.12	0 to 17.0 feet, green and dark gray siliceous altered limestone.
5.0	10.0	5.0	98	.12	
10.0	19.5	9.5	82	.14	17.0 to 19.5 feet, mineralized limestone with pyrite, galena, epidote; grading from dark gray to white at contact. Limestone-granite contact approximately 18.7 feet.
19.5	23.8	4.3	84	2/	19.5 to 23.8 feet, moderately firm fine-grained kaolinized granite.
23.8	27.5	3.7	73	.01	23.8 to 48.5 feet, white, very soft altered kaolinized granite with veins of pure kaolin. Granite has a fine sugary texture because of kaolinized feldspars between unaltered quartz crystals.
27.5	33.0	5.5	93	3/	
33.0	38.0	5.0	100	4/	
38.0	44.0	6.0	63	4/	
44.0	49.0	5.0	90	2/	
49.0	54.0	5.0	50	4/	48.5 to 187.0 feet, granite.
54.0	59.0	5.0	72	2/	
59.0	64.0	5.0	86	.01	
64.0	69.0	5.0	88	2/	
69.0	73.0	4.0	38	3/	
73.0	79.0	6.0	77	2/	
79.0	88.6	9.6	83	4/	
88.6	93.8	5.2	96	2/	
93.8	114.0	20.2	88	4/	
114.0	119.0	5.0	84	.23	114.0 to 119.0 feet, analyzed petrographically (see sample DMEA-1 in section entitled "Petrography.").
119.0	124.5	5.5	82	.02	
124.5	130.5	6.0	95	2/	
130.5	137.0	6.5	95	2/	
137.0	141.0	4.0	98	4/	
141.0	146.0	5.0	100	2/	
146.0	155.0	9.0	98	4/	
155.0	167.0	12.0	93	.03	
167.0	177.0	10.0	98	.02	
177.0	187.0	10.0	100	.06	

1/ Altered limestone: Total footage assayed, 0 to 19.5 = 19.5 feet
Weighted average grade = 0.13 percent BeO
Granite: Total footage assayed, 19.5 to 187.0 = 158.0 feet
Weighted average grade = 0.02 percent BeO.

2/ Trace.

3/ No assay, no BeO detected during scan of sample.

4/ Nil.

TABLE 11. - Diamond-drill hole logs and analyses, DMEA hole 2

Location: 195 X-cut west
Station: 314+22 feet
Depth: 173 feet
Bearing: S 5° E
Inclination: -60°

Date begun: June 22, 1955
Date finished: July 3, 1955
Core sizes: BX to 21.8 feet
AX to 96.6 feet
EX to 173 feet

Footage			Core recovery, percent	BeO nuclear analyses, percent[1/]	Project engineer's log and description
From	To	Distance			
0.0	10.0	10.0	100	0.05	0 to 21.8 feet, white slightly altered limestone cut by numerous unoriented fractures. Some fluorite and sulfides found as fracture filling. The limestone along the fractures is altered to a dark green.
10.0	20.8	10.8	100	.11	
20.8	26.0	5.2	94	.25	21.8 to 28.0 feet, dark green fluoritized limestone cut by calcite veinlets and vugs containing fluorite associated with calcite.
26.0	34.5	8.5	91	.19	28.0 to 34.5 feet, mottled gray-green to cinnamon brown completely altered limestone(?) with small calcite inclusions.
34.5	37.4	2.9	97	.05	34.5 to 35.5 feet, mottled gray-green altered limestone with numerous calcite inclusions and considerable amounts of lead and iron sulfides. 35.5 to 37.0 feet, light gray-green moderately altered limestone.
37.4	42.6	5.2	63	.02	37.0 to 37.5 feet, white calcareous intrusive with pyrite and wolframite. 37.5 to 43.0 feet, green to black altered limestone, no carbonate detected except as calcite inclusions and veinlets.
42.6	45.0	2.4	100	.09	43.0 to 44.5 feet, mineralized calcite, galena, and pyrite visible.
45.0	49.0	4.0	90	.04	44.5 to 48.8 feet, black, fine-grained basalt with calcareous inclusions.
49.0	50.5	1.5	100	.16	48.8 to 50.0 feet, mineralized calcite with some fluorite.
50.5	62.5	12.0	87	.10	50.0 to 73.0 feet, strongly altered limestone with numerous bands of sulfide minerals. Calcareous clay, calcite, tourmaline, and mica abundant. Abundant dull to cinnamon colored garnet(?) 63.0 to 66.0 feet.
62.5	65.8	3.3	94	.12	
65.8	76.0	10.2	97	.04	

TABLE 11. - Diamond-drill hole logs and analyses, DMEA hole 2 (continued)

Footage			Core recovery, percent	BeO nuclear analyses, percent 1/	Project engineer's log and description
From	To	Distance			
76.0	81.0	5.0	96	0.04	76.0 to 80.0 feet, clay believed to be chiefly derived from the alteration of limestone. 80 feet, limestone-granite contact (± 2 feet). 80.0 to 83.0 feet, clay (kaolin), chiefly derived from the alteration of granite.
81.0	94.0	13.0	86	.01	83.0 to 173.0 feet, white to greenish white kaolinized granite with some kaolin veins up to 5 inches across. Some fluorite noted at 90 feet. Granite varies in hardness because kaolinization of feldspars is not consistent. Granite has a loose sugary texture and can be crumbled with the fingers because the feldspars are kaolinized. The quartz and mica are relatively unaltered. No visible mineralization.
94.0	103.4	9.4	81	2/	
103.4	115.0	11.6	89	2/	
115.0	125.0	10.0	85	.01	
125.0	135.0	10.0	50	2/	
135.0	173.0	38.0	62	3/	

1/ Altered limestone: Total footage assayed, 0 to 81.0 = 81.0 feet
Weighted average grade = 0.09 percent BeO
Granite: Total footage assayed, 81.0 to 135.0 = 54.0 feet
Weighted average grade = trace BeO.

2/ Trace.

3/ No assay, no BeO detected during scan of sample.

TABLE 12. - Diamond-drill hole logs and analyses, DMEA hole 3

Location: 195 X-cut west
Station: 314+22 feet
Depth: 225.5 feet
Bearing: 0°
Inclination: 90°

Date begun: July 3, 1955
Date finished: July 14, 1955
Core sizes: BX to 34.5 feet
AX to 92 feet
EX to 225.5 feet

Footage			Core recovery, percent	BeO nuclear analyses, percent[1/]	Project engineer's log and description
From	To	Distance			
0.0	5.0	5.0	88	0.13	0 to 1.0 foot, white limestone with fluoritization along fracture surfaces.
5.0	10.0	5.0	99	.23	1.0 to 14.0 feet, mottled gray-green to brownish-green altered limestone.
10.0	14.5	4.5	99	.17	
14.5	20.0	5.5	73	.12	14.0 to 26.5 feet, gray, broken limestone cut by numerous calcite-filled fractures. In some places the limestone is soft and claylike.
20.0	28.0	8.0	84	.16	
28.0	34.5	6.5	82	.14	26.5 to 33.5 feet, harder zone of altered limestone containing a large amount of red to cinnamon colored garnet. 33.5 to 34.5 feet, gray, fractured, moderately hard limestone fragments in a matrix of soft calcareous clay.
34.5	39.8	5.3	85	.03	34.5 to 39.2 feet, fractured gray limestone with some calcareous clay in the fractures, some sulfide mineralization and some garnet.
39.8	46.8	7.0	93	.01	39.2 to 42.6 feet, bleached white altered limestone with a high percentage of fluorite and chlorite. 42.6 to 45.0 feet, similar bleached altered limestone but harder. Fine-grained dark minerals and pyrite relatively abundant. 45.0 to 46.2 feet, very soft altered limestone with a very high percentage of chlorite.
46.8	52.0	5.2	100	.01	46.2 to 52.0 feet, soft white to pale pink fine-grained kaolinized granite with no visible mineralization.
52.0	58.7	6.7	98	2/	52.0 to 58.0 feet, gray bands of alternating soft and hard granite with visible sulfide mineralization.

TABLE 12. - Diamond-drill hole logs and analyses, DMEA hole 3 (continued)

Footage			Core recovery, percent	BeO nuclear analyses, percent 1/	Project engineer's log and description
From	To	Distance			
58.7	63.2	4.5	69	2/	58.0 to 80.0 feet, hard, gray fine-grained strongly mineralized granite. Fine grains of pyrite, chalcopyrite, and galena disseminated throughout. Very little bleaching or kaolinization except along a few small fractures.
63.2	68.0	4.8	92	2/	
68.0	225.5	157.5	85	3/	80.0 to 225.5 feet, granite.

1/ Altered limestone: Total footage assayed 0 to 46.8 = 46.8 feet
Weighted average grade = 0.12 percent BeO.
Granite: Total footage assayed 46.8 to 68.0 = 21.2 feet
Weighted average grade = trace BeO.

2/ Nil.

3/ No assay, no BeO detected during scan of sample.

TABLE 13. - Diamond-drill hole logs and analyses, DMEA hole 4

Location: 125 X-cut south
Station: Face
Depth: 174 feet
Bearing: 0°
Inclination: 90°

Date begun: July 14, 1955
Date finished: July 23, 1955
Core sizes: BX to 31.5 feet
AX to 110.6 feet
EX to 174 feet

Footage			Core recovery, percent	BaO nuclear analyses, percent[1/]	Project engineer's log and description
From	To	Distance			
0.0	3.5	3.5	71	0.22	0 to 1.0 foot, altered, fractured limestone. 1.0 to 1.5 feet, granitic dike.
3.5	8.7	5.2	95	.19	1.5 to 95.0 feet, hard, intensely altered limestone varying in color from white through green, brown, and black. Numerous unoriented fractures seem to have served as channels of mineralization. Scattered sulfides observed along fractures. Garnet is prominent from 24 to 26 feet. Some chlorite below 90 feet grades into more intense chloritization.
8.7	13.9	5.2	95	.17	
13.9	18.9	5.0	96	.13	
18.9	23.7	4.8	96	.18	
23.7	26.7	3.0	96	.10	
26.7	27.5	.8	96	.11	
27.5	31.5	4.0	96	.09	
31.5	35.5	4.0	85	.06	
35.5	36.1	.6	93	.02	
36.1	39.8	3.7	93	.13	
39.8	45.0	5.2	100	.08	
45.0	48.0	3.0	100	.10	
48.0	50.5	2.5	100	.16	
50.5	55.5	5.0	94	.13	
55.5	57.4	1.9	95	.18	
57.4	59.2	1.8	95	.16	
59.2	61.3	2.1	93	.24	
61.3	66.3	5.0	93	.18	
66.3	67.7	1.4	98	.31	
67.7	72.0	4.3	98	.07	
72.0	77.0	5.0	88	.17	
77.0	79.2	2.2	84	.03	
79.2	82.0	2.8	84	.08	
82.0	87.0	5.0	94	.09	
87.0	91.0	4.0	100	.04	
91.0	92.0	1.0	100	.06	
92.0	97.0	5.0	88	.09	95.0 to 99.0 feet, chloritized limestone with a few small stringers of granite.
97.0	99.0	2.0	85	.09	
99.0	105.5	6.5	55	.02	99.0 to 109.2 feet, intensely kaolinized granite with very little quartz. Limestone-granite contact approximately 100 feet.
105.5	110.6	5.1	94	.03	

TABLE 13. - Diamond-drill hole logs and analyses, DMEA hole 4 (continued)

Footage			Core recovery, percent	BeO nuclear analyses, percent 1/	Project engineer's log and description
From	To	Distance			
110.6	115.6	5.0	72	0.01	109.2 to 174.0 feet, strongly kaolinized granite with a sugary texture because of unaltered quartz and mica grains. Kaolinization less intense 115 to 127.9 feet. Irregular inclusions of dark minerals 127.9 to 132.0 feet. Kaolinization more intense 132.0 to 138.0 feet.
115.6	120.6	5.0	66	.01	
120.6	174.0	53.4	69	2/	

1/ Altered limestone: Total footage assayed, 0 to 99.0 = 99.0 feet
Weighted average grade = 0.13 percent BeO
Granite: Total footage assayed, 99.0 to 120.6 = 21.6 feet
Weighted average grade = 0.02 percent BeO.

2/ No assay, no BeO detected during scan of sample.

TABLE 14. - Diamond-drill hole logs and analyses, DMEA hole 6

Location: Calcite Drift
Station: Face
Depth: 366.3 feet
Bearing: N 13° E (approximately)
Inclination: -60°

Date begun: July 31, 1955
Date finished: August 8, 1955
Core sizes: BX to 10 feet
AX to 87.2 feet
EX to 366.3 feet

Footage			Core recovery, percent	BeO nuclear analyses percent 1/	Project engineer's log and description
From	To	Distance			
0.0	25.0	25.0	90	2/	0 to 80.0 feet, hard, light gray unaltered granite with almost no visible mineralization or kaolinization.
25.0	30.1	5.1	100	4/	
30.1	35.4	5.3	100	3/	
35.4	40.1	4.7	100	0.06	
40.1	112.2	72.1	98	2/	80.0 to 111.0 feet, granite.
112.2	117.4	5.2	79	3/	111.0 to 127.0 feet, fracture zone with heavy water flow, hard granite is yellow, iron stain is prominent on fracture surfaces. No kaolinization observed.
117.4	122.4	5.0	79	3/ 5/	
122.4	126.7	4.3	79	3/	
126.7	131.7	5.0	86	3/ 5/	
131.7	137.0	5.3	86	4/	127.0 to 137.0 feet, hard, light gray, unmineralized unkaolinized granite.
137.0	142.1	5.1	92	4/	137.0 to 180.5 feet, hard, gray granite with moderately weak disseminated sulfide mineralization. Veins or segregations of tourmaline. Faint traces of kaolinization.
142.1	147.7	5.6	88	3/	
147.7	153.3	5.6	88	4/	
153.3	158.3	5.0	88	4/	
158.3	184.2	25.9	83	2/	180.5 to 216.8 feet, hard, gray, unmineralized granite, very faint traces of kaolinization.
184.2	191.3	7.1	82	4/	
191.3	211.8	20.5	100	2/	
211.8	216.8	5.0	98	4/	
216.8	221.9	5.1	98	4/	216.8 to 220.0 feet, hard, darker gray granite with weakly disseminated sulfides and traces of green tourmaline.
221.9	366.3	144.1	94	2/	220.0 to 366.3 feet, granite with traces of kaolinization.

1/ Granite: Total footage assayed (nuclear analyses), 25.0 to 221.9 = 78.4 feet
Weighted average grade = trace BeO.
2/ No assay, no BeO detected during scan of sample.
3/ Trace.
4/ Nil.
5/ Chemical analyses of composite samples 87.5 to 122.4 and 126.7 to 158.3 indicate less than 0.01 percent BeO.

TABLE 15. - Diamond-drill hole logs and analyses, DMEA hole 7

Location: Calcite Drift
Station: Face
Depth: 242 feet
Bearing: N 90° W (approximately)
Inclination: 0°

Date begun: August 9, 1955
Date finished: August 12, 1955
Core sizes: BX to 5 feet
AX to 242 feet

Footage			Core recovery, percent	BeO nuclear analyses, percent 1/	Project engineer's log and description
From	To	Distance			
0.0	35.5	35.5	97	2/	0 to 46.0 feet, slightly fractured, hard, light gray granite with a very small amount of disseminated sulfide mineralization and no kaolinization.
35.5	40.7	5.2	96	0.01	
40.7	63.6	22.9	86	2/	
63.6	68.8	5.2	94	3/	46.0 to 121.7 feet, hard, darker gray-green granite with numerous iron-stained, water-filled fractures, no kaolinization, some tourmaline in quartz at 101 feet, disseminated sulfides observed, but not abundant.
68.8	74.0	5.2	94	2/	
74.0	79.2	5.2	99	3/	
79.2	103.0	23.8	89	2/	
103.0	111.0	8.0	75	.01	
111.0	116.5	5.5	81	4/	
116.5	121.7	5.2	81	3/	
121.7	127.0	5.3	99	4/	121.7 to 140.0 feet, granite similar but iron-stained fractures absent. No kaolinization.
127.0	135.5	8.5	97	2/	
135.5	141.0	5.5	97	.02	
141.0	146.0	5.0	100	2/	140.0 to 160.0 feet, hard, light gray to red-brown granite, no kaolinization, fracture fillings and disseminations of a dark brown to black mineral (probably a manganese).
146.0	151.0	5.0	100	3/	
151.0	156.0	5.0	100	4/	
156.0	161.0	5.0	99	4/	
161.0	168.0	7.0	69	4/	160.0 to 170.0, dark, hard, gray-green granite with a weak dissemination of sulfides, a few iron-stained fractures, and no kaolinization.
168.0	173.0	5.0	100	4/	
173.0	178.0	5.0	74	3/	170.0 to 178.8 feet, hard, red-brown granite with unidentified dark brown mineral abundant, traces of kaolinization. Granite-limestone contact at 178.8, no kaolinization, gouge, or fractures.
178.0	183.3	5.3	94	1.06 6/	178.8 to 217.0 feet, gray to dark green, hard, moderately altered limestone.
183.3	188.5	5.2	96	.21 5/	
188.5	193.6	5.1	99	.13	
193.6	198.9	5.3	99	.07	
198.9	204.1	5.2	80	.34	
204.1	209.4	5.3	80	.12	
209.4	214.5	5.1	80	.33	

TABLE 15. - Diamond-drill hole logs and analyses, DMEA hole 7 (continued)

Footage			Core recovery, percent	BeO nuclear analyses, percent 1/	Project engineer's log and description
From	To	Distance			
214.5	218.0	3.5	54	0.04	217.0 to 234.0 feet, moderately kaolinized acidic intrusive.
218.0	223.0	5.0	88	.01	
223.0	228.6	5.6	30	.01	
228.6	234.6	6.0	45	.05	
234.6	242.0	7.4	47	.19	234.0 to 242.0 feet, fractured, altered, light gray-green limestone.

1/ Altered limestone: Total footage assayed, 178.0 to 242.0 = 64.0 feet
Weighted average grade = 0.22 percent BeO
Granite: Total footage assayed, 35.5 to 178.0 = 77.1 feet
Weighted average grade = trace BeO.

2/ No assay, no BeO detected during scan of sample.

3/ Trace.

4/ Nil.

5/ Composite, sample 183.3-223.0 is 0.13 percent BeO by chemical analyses.

6/ Chemical analysis.

TABLE 16. - Diamond-drill hole logs and analyses, DMEA hole 8

Location: 125 X-cut south
Station: Face
Depth: 288 feet
Bearing: S 16°30' W
Inclination: -45°

Date begun: August 13, 1955
Date finished: August 22, 19
Core sizes: BX to 10 feet
AX to 152.3 feet
EX to 288 feet

Footage			Core recovery, percent	BeO nuclear analyses, percent[1]	Project engineer's log and description
From	To	Distance			
0.0	8.0	8.0	56	0.11	0 to 1.5 feet, hard, mottled dark green altered limestone.
8.0	12.7	4.7	74	.36	1.5 to 13.0 feet, light gray to white altered limestone.
12.7	15.6	2.9	76	.13	13.0 to 14.5 feet, dark green to dark brown limestone with some sulfide mineralization.
15.6	17.0	1.4	76	.17	14.5 to 36.0 feet, moderately hard, more altered green to gray limestone with numerous calcite veinlets and some small veinlets of sulfide minerals.
17.0	20.0	3.0	76	.18	
20.0	25.0	5.0	76	.14	
25.0	30.0	5.0	76	.02	
30.0	35.0	5.0	76	.09	
35.0	39.8	4.8	76	.29	36.0 to 97.0 feet, softer, bleached gray-white to pale mottled green strongly altered limestone with clay gouge along fracture surfaces. Sulfide veinlet at 45 feet with only traces of sulfides other places.
39.8	42.0	2.2	76	.03	
42.0	47.0	5.0	76	.01	
47.0	52.0	5.0	76	.03	
52.0	54.5	2.5	76	.09	
54.5	59.7	5.2	76	.10	
59.7	65.0	5.3	76	.05	
65.0	69.6	4.6	31	.03	
69.6	74.0	4.4	31	.01	
74.0	79.2	5.2	31	.01	
79.2	86.0	6.8	36	.05	
86.0	91.0	5.0	36	.04	
91.0	96.5	5.5	36	.04	
96.5	98.5	2.0	96	4/	97.0 to 138.0 feet, "greasy" green "soapstone" limestone largely altered to chlorite.
98.5	103.5	5.0	96	.01	
103.5	109.2	5.7	4	2/	
109.2	116.0	6.8	93	3/	
116.0	121.5	5.5	91	3/	
121.5	127.0	5.5	91	.01	
127.0	130.8	3.8	92	3/	
130.8	136.0	5.2	88	4/	
136.0	141.2	5.2	69	.01	138.0 to 152.3 feet, hard, broken limestone.
141.2	146.8	5.6	71	4/	
146.8	152.3	5.5	62	3/	

TABLE 16. - Diamond-drill hole logs and analyses, DMEA hole 8 (continued)

Footage			Core recovery, percent	BeO nuclear analyses, percent 1/	Project engineer's log and description
From	To	Distance			
152.3	158.0	5.7	26	0.01	152.3 to 158.0 feet, alteration products and dispersed sulfide mineralization in a clay matrix. 158 ± 5 feet, limestone-granite contact.
158.0	163.5	5.5	56	4/	158.0 to 190.4 feet, intensely kaolinized, soft, altered granite.
163.5	169.5	6.0	72	3/	
169.5	174.4	4.9	47	4/	
174.4	190.4	16.0	38	4/	
190.4	239.8	49.4	50	2/	190.4 to 228.0 feet, harder, kaolinized granite.
239.8	245.4	5.6	57	4/	228.0 to 275.0 feet, sugary textured, kaolinized granite.
245.4	269.0	23.6	90	2/	
269.0	273.5	4.5	73	4/	
273.5	288.0	14.5	80	2/	275.0 to 288.0 feet, harder, slightly kaolinized, bleached, altered granite.

1/ Altered limestone: Total footage assayed, 0 to 96.5 feet = 96.5 feet
Weighted average grade = 0.09 percent BeO
Chloritic limy soapstone: Total footage assayed, 96.5 to 158.0 = 55.8 feet
Weighted average grade = trace BeO
Granite: Total footage assayed, 158.0 to 288.0 = 130.0 feet
Weighted average grade = nil.

2/ No assay, no BeO detected during scan of sample.

3/ Trace.

4/ Nil.

TABLE 17. - Beryllium analyses, percussion long-hole samples, 365 level

Hole number	Sample 1/									
	1	2	3	4	5	6	7	8	9	10
1	0.11	0.09	0.03	0.03	0.07	0.10	0.09	0.10	0.08	2/
2	.01	.02	.10	.06	.11	.07	.08	.08	2/	2/
3	.08	.48	.10	.02	.07	.09	.09	.11	.08	0.11
4	.09	.10	.09	3/	.13	3/	3/	3/	3/	3/
5	.05	.01	.03	.09	.11	.11	.14	.05	.07	.07
6	.11	.05	.01	.04	.06	.20	.12	.07	.13	.07
7	.09	.08	.01	.07	.13	.04	.03	.17	.06	2/
8	.15	.06	.01	.08	.12	.04	.04	.04	2/	2/
9	.28	.09	.01	.35	.26	.08	.15	.21	2/	2/
10	.11	.12	.12	.05	4/	.08	.08	.07	.09	2/
17	.11	.07	.06	.10	.02	.02	.06	.09	2/	2/
18	.14	.09	.05	.01	.01	.03	.05	.02	2/	2/
19	.22	.04	.01	.12	.09	.14	.10	.09	2/	2/
21	.12	3/	3/	3/	3/	3/	3/	.09	3/	3/

1/ The percentage of BeO was determined by chemical analysis. Samples represent 5-foot intervals beginning at the collar of the holes. Underlined analyses are for samples wholly or partly in the Cassiterite Dike. The weighted average grade of altered limestone from the north wall of the Cassiterite Dike is 90 feet containing 0.10 percent BeO. The weighted average grade of samples wholly or partly in the Cassiterite Dike, including hole 2, is 195 feet containing 0.07 percent BeO. The weighted average grade of altered limestone samples from the south wall of the Cassiterite Dike excluding holes 4 and 21, is 260 feet of 0.09 percent BeO.

2/ No sample.

3/ Less than 0.10 percent BeO.

4/ Less than 0.01 percent BeO.

TABLE 18. - Mill-test samples, 365 level

Sample	Description	Percent BeO nuclear analyses	Percent BeO chemical analyses
87	Altered granite mill-test sample from contact zone.	1/	0.01
88	Altered limestone mill-test sample from contact zone.	1/	.03
89	Same as 87 from south wall of crosscut............	1/	2/
90	Same as 87 from south wall of drift...............	1/	.06

1/ No assay.
2/ Trace.

Summary of Sampling Results

The initial quantitative analyses of specimens from the Lost River mine indicated that some specimens contained more beryllium than would occur in the minerals identifiable in the Juneau petrographic laboratory. Analyses of some of the better grade samples at the Bureau's Albany, Oregon laboratory by x-ray diffraction revealed that cryptocrystalline chrysoberyl is present in banded fluoritized limestone. The chrysoberyl could not be recognized visually even after its presence was known, but the characteristic banded rock in which it occurs is readily recognizable. The highest grade specimen found in place was a white veinlet in fluoritized limestone that contained 5 percent BeO. The average grade of the altered limestone exposed in an area 1,000 feet long and 500 feet wide adjacent to the Lost River tin mine is about 0.13 percent BeO. Except at the granite contact, no essential difference was noted between the altered limestone at the surface and at the 365 level. Only traces of beryllium occur in the underlying granite. Table 19 summarizes the sampling data.

TABLE 19. - Summary of sampling results

Rock type	Table	Drill hole	Distance, feet	Average grade, percent BeO
Altered limestone total or unweighted average[1].	3	Percussion[2]	620	0.13
Altered limestone[1]........................	4	DDH-1	207	.13
Do....................................	5	DDH-2	96	.09
Do....................................	6	DDH-24	69	.03
Do....................................	6	DDH-24	180	.14
Do....................................	6	DDH-24	116	.09
Do....................................	7	DDH-25	36	.17
Do....................................	8	DDH-26	132	.15
Altered limestone total or weighted average[3]			836	.12
Altered limestone[4]........................	10	DMEA-1	20	.13
Do....................................	11	DMEA-2	81	.09
Do....................................	12	DMEA-3	47	.12
Do....................................	13	DMEA-4	99	.13
Do....................................	15	DMEA-7	64	.22
Do....................................	16	DMEA-8	96	.09
Altered limestone total or weighted average[5]			407	.13
Granite................................	10	DMEA-1	158	.02
Do....................................	11	DMEA-2	54	Trace
Do....................................	12	DMEA-3	21	Trace
Do....................................	13	DMEA-4	22	.02
Do....................................	14	DMEA-6	68	Trace
Do....................................	15	DMEA-7	77	Trace
Do....................................	16	DMEA-8	130	Nil
Granite total or weighted average			530	Trace
Chloritic limestone.....................	16	DMEA-8	56	Trace
Cassiterite Dike........................	17	Percussion[6]	195	.07
Footwall, Cassiterite Dike..............	17	....do....	90	.10
Hanging wall, Cassiterite Dike..........	17	....do....	260	.09

1/ Does not include the limestone of the granite-limestone contact zone.
2/ All percussion holes in area that averaged over 0.1 percent BeO (fig. 4).
3/ Diamond-drill holes drilled from the surface.
4/ Includes some altered limestone at the granite-limestone contact.
5/ Diamond-drill holes drilled from 365 level.
6/ Includes all percussion-drill holes wholly or partly in the Cassiterite Dike on the 365 level.

Spectrographic Analyses

Nineteen typical specimens and chip samples were analyzed spectrographically. All contained beryllium associated with a mineral assemblage typical of the Seward Peninsula tin belt. Results are in table 20. Sample descriptions are in table 2. Sample locations are on figure 3.

TABLE 20. - Spectrographic analyses of typical specimens and samples from the Lost River mine area[1/]

Sample[2/]	Ag	Al	B	Ba	Be	Bi	Ca	Cd	Cr	Cu	Fe	Ga	Li	Mg	Mn	Mo	Na	Nb	Ni	Pb	Si	Sn	Ti	V	W	Zn	Zr	Sc	Y
1	F	A	E	-	F	-	A	-	F	D	A	D	E	C	D	F	D	-	E	E	A	C	F	F	-	-	F	-	F
4	-	B	E	-	F	-	A	-	-	G	B	E	-	D	D	-	E	-	-	E	B	E	E	E	-	-	F	F	-
6	-	B	E	-	F	-	A	-	-	G	B	E	E	B	D	-	D	-	-	E	B	E	E	F	-	-	F	-	-
11	-	A	E	-	F	-	A	E	F	G	A	E	E	A	D	F	C	-	F	E	A	D	E	E	-	-	F	F	-
14	F	A	E	-	F	F	A	-	-	F	A	E	E	B	D	F	D	-	F	D	A	D	E	F	E	-	F	-	-
16	G	B	E	-	E	F	A	-	-	F	A	E	E	B	D	F	D	-	-	E	B	D	F	-	E	E	-	-	-
20	F	A	E	-	E	F	A	-	-	F	A	E	D	B	D	F	D	-	-	E	B	D	F	-	E	E	F	F	-
23	F	A	E	-	E	-	A	-	F	F	A	D	E	C	D	F	D	-	E	E	A	C	F	F	-	E	F	-	-
35	G	A	E	-	E	F	A	-	-	F	B	E	E	B	D	F	D	-	-	D	B	D	E	-	E	E	F	-	-
39	F	A	E	-	E	E	A	-	-	F	A	E	E	A	D	E	D	-	-	D	A	C	F	-	E	E	F	-	-
41 and 43 composite	F	A	D	-	F	-	A	-	-	F	A	E	E	A	D	F	E	-	-	D	A	D	E	F	-	E	F	-	F
42	E	A	E	-	E	F	A	-	-	F	A	E	E	B	D	F	D	-	-	D	A	D	E	-	-	E	F	-	-
44	F	A	E	-	E	F	A	-	-	F	A	E	D	B	D	F	D	-	-	D	A	D	F	-	-	E	F	-	-
45	F	A	C	E	E	-	B	-	-	F	A	D	D	A	D	E	D	-	F	D	A	D	C	E	-	E	E	F	-
46	F	A	E	-	E	F	A	-	F	E	A	D	D	B	D	F	D	-	E	D	A	C	F	F	E	D	F	-	-
50	G	A	D	-	E	F	A	-	-	F	A	D	E	B	D	F	D	-	-	D	A	D	E	-	-	E	F	-	-
58	F	A	D	-	F	-	A	E	-	F	A	E	E	B	D	F	D	-	F	D	A	D	E	-	-	E	F	-	-
61	G	A	E	-	F	F	B	-	-	F	A	D	D	C	D	F	D	E	F	D	A	D	F	-	-	E	F	-	F
62	F	A	E	-	F	-	B	-	-	F	A	D	E	D	D	F	D	E	F	D	A	D	F	-	-	E	F	-	F

Remarks: As, Au, Co, Ge, Hf, Hg, In, Ir, Os, P, Pd, Pt, Re, Rh, Ru, Sb, Sr, Ta, Te, and Tl were not detected.

1/ A Over 10 percent
B 5 to 10 percent
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.

2/ Samples are described in table 2 and shown on figure 3.

Petrography

by

Walter L. Gnagy[4/]

4/ Petrographer, Area VIII Mineral Resource Office, Bureau of Mines, Juneau, Alaska.

Tabulated Analyses

A suite of specimens and samples from the Lost River mine was studied at the Bureau of Mines petrographic laboratory at Juneau, Alaska. Two specimens were submitted to Peter A. Romans of the Albany Metallurgy Research Center for x-ray diffraction analyses when it became apparent that the amount of beryllium present was greater than could be included in the beryllium minerals identified at Juneau. Field descriptions of numbered samples are in tables 2 and 9; location of DMEA-1 is in table 10. Sample locations are shown on figures 3 and 5. Numbers following the sample number (e.g., 70-1, 70-2, etc.) refer to lithologic variations within the sample. Rocks and component minerals are identified in tables 21 and 22; additional data that could not be tabulated have been included as supplemental notes.

TABLE 21. - Petrographic Identifications[1/]

Sample No.	2	3	5	6	7	8	9	10	12	13	22	24	27	28	30	32	34	37	39
Rocks:																			
Greisen	C	-	-	-	-	C	C	-	-	-	-	C	C	C	C	C	-	-	-
Limestone	-	-	-	C	-	C	-	-	C	C	-	C	C	C	C	C	-	C	C
Soda trachyte	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tactite	-	-	C	-	C	C	-	-	C	-	C	-	C	-	-	C	C	C	C
Minerals:																			
Actinolite	-	-	-	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Albite	+	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+
Aminoffite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Andesine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M
Anorthite	-	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Apatite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryl	+	+	X	+	+	+	+	+	+	+	+	T	+	+	+	+	+	+	+
Beta quartz	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biotite	-	-	-	-	-	-	-	-	-	-	-	-	T	-	-	-	-	-	-
Calcite	-	-	T	P	S	P	-	-	A	P	-	P	A	P	A	P	M	P	A
Cancrinite	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-
Cassiterite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	T
Chlorite	-	-	-	T	-	-	T	-	A	-	S	M	-	-	M	F	-	F	A
Diaspore	-	-	-	-	-	-	-	-	-	+	+	+	-	-	+	-	-	-	-
Dolomite	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-
Epidote	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorite	-	M	A	T	A	S	A	38	A	M	A	A	A	A	A	S	P	A	A
Galena	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Garnet	-	-	-	-	-	-	-	-	-	-	A	T	-	-	-	-	-	-	T
Grossularite I = 1.74	-	-	-	-	-	-	-	-	-	-	-	-	M	+	-	-	-	-	-
Grossularite I = 1.75	-	-	-	-	-	-	-	-	-	-	-	-	M	+	-	-	-	-	-
Hornblende	-	-	-	-	A	-	-	-	-	-	T	-	-	-	-	F	-	F	-
Hydromuscovite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kaolin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Labradorite	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-
Lepidolite	A	-	-	M	S	M	A	-	-	S	S	A	M	A	A	S	F	-	-
Limonite	T	M	T	-	M	-	M	-	F	T	-	-	-	-	-	-	-	-	-
Magnetite	-	-	-	-	-	-	-	-	-	-	-	T	-	-	-	-	-	M	S
Muscovite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	F
Orthoclase	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenacite and chrysoberyl	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Powellite	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	F	M
Protolithianite	-	-	-	-	-	-	-	-	S	-	-	-	-	-	-	-	-	-	-
Pyrite	T	-	-	-	-	-	-	-	-	-	+	T	-	-	T	-	-	T	-
Quartz	A	-	-	-	-	-	-	40	-	-	-	-	-	-	-	-	-	+	+
Sanadine	+	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scheelite	-	-	-	-	T	T	-	T	-	-	+	-	-	-	-	+	+	T	F
Sericite	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-
Sphalerite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphene	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-
Spinel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Topaz	M	M	-	-	-	-	-	47	F	-	-	-	-	-	-	-	-	-	-
Tourmaline	M	-	A	-	-	T	T	-	A	-	-	M	M	T	+	-	F	T	F
Tremolite	-	-	-	A	-	S	-	-	-	-	-	-	-	-	-	-	-	-	-
Vesuvianite	-	-	-	-	A	-	-	-	-	F	-	F	-	+	+	A	A	S	-
Wolframite	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	-	-	-
Zinnwaldite	-	-	-	-	-	-	S	-	-	-	-	-	A	M	-	-	-	-	-

See footnotes at end of table.

TABLE 21. - Petrographic identifications (continued)[1]

Sample No.	40-1	40-2	44	47-1	47-2	47-3	47-4	47-5	51	52	57	59	60	63
Rocks:														
Greisen	-	-	-	-	-	C	C	-	-	-	-	C	C	-
Limestone	C	C	C	C	-	-	-	-	C	C	C	C	-	-
Soda trachyte	-	-	-	-	-	-	-	-	-	-	-	-	-	C
Tactite	-	-	-	-	C	C	C	-	-	-	-	-	-	-
Minerals:														
Actinolite	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Albite	-	-	-	-	-	-	-	-	-	-	-	-	-	P
Aminoffite	-	-	-	?	?	-	-	-	-	-	-	-	-	-
Andesine	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anorthite	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Apatite	-	-	-	-	-	-	-	-	-	-	-	M	-	-
Beryl	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Beta quartz	-	-	-	-	-	-	-	-	-	-	-	-	-	A
Biotite	-	-	-	-	-	-	-	-	-	-	-	M	-	-
Calcite	P	P	P	P	A	S	A	-	P	P	P	A	-	+
Cancrinite	F	+	-	-	-	-	-	-	-	-	-	-	-	-
Cassiterite	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorite	-	-	A	-	-	-	-	-	-	M	-	-	S	-
Diaspore	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Dolomite	F	+	-	-	-	-	-	-	T	T	T	-	-	-
Epidote	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorite	M	A	A	A	A	+	A	-	M	T	F	A	P	-
Galena	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Garnet	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grossularite I = 1.74	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Grossularite I = 1.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hornblende	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydromuscovite	-	-	-	-	-	M	-	-	-	-	-	-	-	-
Kaolin	-	-	-	-	-	-	-	-	-	M	-	-	-	-
Labradorite	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lepidolite	M	+	S	-	-	-	-	-	-	-	F	-	-	-
Limonite	-	-	-	-	-	-	-	-	-	T	-	M	-	M
Magnetite	-	-	-	-	-	-	-	P	-	-	-	-	A	-
Muscovite	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Orthoclase	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenacite and chrysoberyl	+	+	+	+	+	+	+	+	+	+	+	+	-	-
Powellite	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Protolithianite	-	-	-	-	-	A	P	-	-	-	-	A	A	+
Pyrite	-	-	T	-	-	-	-	-	-	-	-	-	-	M
Quartz	-	-	-	-	-	M	-	-	-	-	-	+	-	-
Sanadine	-	-	-	-	-	-	-	-	-	-	-	-	-	A
Scheelite	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sericite	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphalerite	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphene	-	-	T	-	T	-	-	-	-	-	-	-	-	-
Spinel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Topaz	-	-	-	-	-	-	-	-	-	-	-	-	-	M
Tourmaline	+	+	F	-	F	S	S	-	T	T	-	M	A	-
Tremolite	-	-	-	-	-	-	-	-	T	-	-	-	-	-
Vesuvianite	+	+	M	-	A	P	A	-	-	-	-	-	-	-
Wolframite	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinnwaldite	M	S	-	-	-	-	-	-	-	-	-	S	-	-

See footnotes at end of table.

TABLE 21. - Petrographic identifications (continued)[1]

Sample No.	70-1	70-2	70-3	70-4	73	75	DMGA-1
Rocks:							
Greisen	-	C	C	-	C	-	C
Limestone	C	-	-	C	-	C	-
Soda trachyte	-	-	-	-	-	-	-
Tactite	-	-	-	-	-	-	-
Minerals:							
Actinolite	-	-	-	-	-	-	-
Albite	-	-	-	-	-	-	-
Aminoffite	-	-	-	-	-	-	-
Andesine	-	-	-	-	-	-	-
Anorthite	-	-	-	-	-	-	-
Apatite	-	-	-	-	-	-	-
Beryl	÷	÷	÷	÷	÷	÷	÷
Beta quartz	-	-	-	-	-	-	-
Biotite	-	-	-	-	-	-	-
Calcite	P	-	M	P	S	P	-
Cancrinite	-	-	-	-	-	-	-
Cassiterite	-	-	-	-	-	-	÷
Chlorite	-	-	-	-	-	-	-
Diaspore	-	-	-	-	-	-	-
Dolomite	-	-	-	-	-	S	-
Epidote	-	-	-	-	-	-	-
Fluorite	T	A	A	M	A	A	T
Galena	-	-	-	-	-	-	F
Garnet	-	-	-	-	-	-	-
Grossularite I = 1.74	-	-	-	-	-	-	-
Grossularite I = 1.75	-	-	-	-	-	-	-
Hornblende	-	-	-	-	-	-	-
Hydromuscovite	-	-	-	-	-	-	-
Kaolin	-	-	-	-	-	-	M
Labradorite	-	-	-	-	-	-	-
Lepidolite	-	-	-	-	-	-	A
Limonite	-	M	-	-	F	-	-
Magnetite	-	T	-	-	-	-	-
Muscovite	-	-	-	-	-	-	-
Orthoclase	-	T	-	-	-	-	-
Phenacite and chrysoberyl	-	-	-	-	-	T[2]	-
Powellite	-	-	-	-	-	-	-
Protolithionite	-	-	-	-	-	÷	-
Pyrite	-	S	-	-	M	-	T
Quartz	-	T	-	-	-	÷	A
Sanadine	-	-	-	-	-	-	-
Scheelite	-	-	-	-	-	-	-
Sericite	-	-	-	-	-	-	-
Sphalerite	-	-	-	-	-	-	F
Sphene	-	-	-	-	-	-	-
Spinel	-	-	-	-	-	-	-
Topaz	-	-	-	-	-	-	M
Tourmaline	-	-	-	-	M	S	M
Tremolite	-	-	-	-	-	-	-
Vesuvianite	-	-	-	-	-	-	-
Wolframite	-	-	-	-	-	-	-
Zinnwaldite	S	P	P	S	P	-	-

1/ P - Predominant — Over 50 percent — Numerals - Percent
A - Abundant — 10 - 50 percent — C - Rock classification
S - Subordinate — 2 - 10 percent — X - Detected in sample
M - Minor — .5 - 2 percent — ÷ - Sought but not detected.
F - Few — .1 - .5 percent
T - Trace — Less than .1 percent

2/ Chrysoberyl.

TABLE 22. - Petrographic identifications of sample fractions obtained by magnetic separations[1]

	+200 -100 mesh fraction							
Sample 26		1[2]	2	3	4	5	6	7
Percent of sample	100.1	77.5	[illegible]	9.9	5.3	0.4	0.7	1.1
Chemical BeO	.5	-	-	-	-	-	-	-
Minerals:								
Biotite	T	-	-	-	-	T	T	-
Calcite	7	9	3	T	T	-	T	-
Chlorite	.8	-	-	1	10	40	2	-
Epidote	T	T	-	-	-	-	-	-
Fluorite	46	55	24	13	1	9	18	25
Grossularite I = 1.74	2	T	1	T	2	+	1	1
Grossularite I = 1.75	T	T	+	T	T	+	T	+
Lepidolite	2	-	15	13	5	-	18	1
Magnetite-pyrrhotite	.4	-	-	-	-	.1	7	40
Spinel[3]	3	3	3	1	2	3	18	10
Tourmaline	4	-	20	12	30	2	7	-
Vesuvianite	T	+	-	T	T	-	1	-
Zinnwaldite	36	33	34	60	50	46	28	23
BeO intensities[4]		3	5	5	9	10	5	1

	+325 -200 mesh fraction									
Sample 26	1[5]	2-4	5	6	7	8	9	10	11	12
Minerals:										
Biotite	-	-	-	-	-	-	-	T	-	-
Calcite	4	8	13	3	F	T	M	-	-	F
Chlorite	-	-	-	-	18	-	35	25	-	-
Epidote	-	-	-	-	-	F	T	-	T	-
Fluorite	60	27	38	30	4	3	3	3	5	-
Grossularite I = 1.74	+	F	T	T	M	F	F	F	F	T
Grossularite I = 1.75	F	T	T	T	T	+	F	-	-	-
Lepidolite	+	9	4	25	25	4	4	M	T	-
Magnetite-pyrrhotite	-	-	-	-	-	-	-	-	15	80
Spinel[3]	-	T	-	T.	F	12	4	10	20	7
Tourmaline	M	M	+	M	M	8	4	F	-	-
Vesuvianite	+	-	-	-	10	1	T	+	-	-
Zinnwaldite	35	55	45	40	40	-	50	60	60	12
Zinnwaldite & chlorite	-	-	-	-	-	70	-	-	-	-
BeO intensities[4]	3	4	2	7	6	10	9	6/	7/	

1/ M - Minor 0.5 - 2 percent; Numerals - percent
F - Few .1 - .5 percent; + - Sought but not detected.
T - Trace Less than .1 percent
2/ Sample fractions 1 to 7 represent increasing magnetic properties towards 7.
3/ Tentative.
4/ Relative values from 1 to 10 by Morin test.
5/ Sample fractions 1 to 12 represent increasing magnetic properties toward 12.
6/ 9 and 10 combined due to insufficient sample.
7/ Insufficient sample for test.

TABLE 23. - Spectroscopic analyses for selected elements1/

Sample No.	2	3	5	6	7	8	9	10	11	12	13	14	15	16	17	20	21	23	24	25	30	31	35	36
Elements:																								
Beryllium	-	-	-	-	T	X	+	+	-	+	X	T	X	T	X	X	T	X	X	-	X	X	X	X
Bismuth	-	-	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	+
Cesium	-	-	-	-	+	T	T	+	X	+	2/	X	X	+	X	X	X	X	X	X	T	+	+	+
Indium	T	-	-	-	T	-	-	+	-	-	-	-	-	-	-	-	-	-	T	-	+	-	-	T
Lead	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	X	-	-	T
Lithium	X	X	-	T	X	X	X	T	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Potassium	-	-	-	X	-	-	-	-	X	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Rubidium	X	X	-	-	+	X	T	+	X	+	X	X	X	+	X	X	X	X	X	X	X	+	X	X
Thallium	-	-	-	-	-	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-	+	-	-	-
Tin	+	-	-	-	T	-	-	+	-	-	-	-	-	-	-	-	-	-	T	-	X	-	-	-
Zinc	-	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-
Sample No.	37	38	39	41	42	43	44	45	46	47-1	47-2	47-3	47-4	48	49	50	53	54	55
Elements:																			
Beryllium	-	X	X	X	X	X	X	X	X	+	X	+	+	X	X	X	-	X	X
Bismuth	+	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-	-	-	-
Cesium	X	+	+	+	+	+	X	2/	X	+	+	X	X	2/	X	X	+	+	+
Indium	T	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
Lead	T	-	T	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
Lithium	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	T
Potassium	X	X	X	X	X	X	X	X	X	X	-	-	-	X	X	X	-	-	-
Rubidium	X	X	X	X	+	+	X	X	X	-	-	X	X	X	X	X	+	+	+
Thallium	-	-	-	-	-	-	-	2/T	-	-	-	-	-	2/T	-	-	-	-	-
Tin	T	-	T	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	T	-	X	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
Sample No.	56	58	59	60	61	62	63	70-1	70-2	70-3	70-4	73	75	DMEA-1
Elements:														
Beryllium	X	-	X	+	T	-	-	X	X	X	X	X	+	X
Bismuth	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cesium	+	-	+	X	-	-	+	X	X	X	X	+	+	X
Indium	-	-	-	+	-	-	-	X	X	X	X	X	-	X
Lead	-	-	-	-	-	-	-	-	-	-	-	-	-	X
Lithium	T	T	X	X	X	X	X	X	X	X	X	X	X	X
Potassium	T	-	-	X	X	X	-	X	X	X	X	X	-	X
Rubidium	+	-	X	X	X	X	X	X	X	X	X	X	+	X
Thallium	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	-	-	-	X	-	-	-	X	X	X	X	X	-	X
Zinc	-	-	-	-	-	-	-	-	-	-	-	-	-	X

1/ X - Detected in sample, amount not determinable.
T - Trace, less than 0.1 percent
F - Few, between 0.1 and 0.5 percent.
\+ - Sought but not detected

2/ No. 13, 0.08 percent cesium by chemical assay; No. 45, 0.14 percent cesium; No. 48, 0.11 percent cesium.

Supplemental Notes on Selected Specimens

Sample No. 2

Rubidium is associated with the lepidolite.

Sample No. 5

The fluorite is colorless and phosphoresces green. The tourmaline in the sample is gray-green.

Sample No. 7

Beryllium is not associated with fluorite in the sample.

Sample No. 8

Beryllium is associated with fluorite and calcite but not with lepidolite; cesium is associated with the lepidolite.

Sample No. 9

Cesium is associated with lepidolite in the sample.

Sample No. 10

The fluorite fluoresces pink. Traces of scheelite are indicated by fluorescence.

Sample No. 24

The amount of beryl detected does not account for the amount of beryllium indicated by chemical assay. The unidentified beryllium minerals may be very fine grained and may have been obscured by the fine-grained lepidolite.

Sample No. 26

The sample was seived to obtain -100 +200 and -200 +325 mesh fractions. The seived fractions were each separated into magnetic fractions by use of the isodynamic magnetic separator. Tests of the +200 -100 mesh fraction indicate that BeO is associated with chlorite-zinnwaldite and to a lesser extent with lepidolite and perhaps with tourmaline but not associated with magnetic fluorite, spinel, or calcite. The beryllium minerals could not be identified.

Tests of the -200 +325 fraction indicate that BeO is associated with the green more magnetic zinnwaldite and green chlorite. Some beryllium may be associated with tourmaline and lepidolite. With increasing magnetic properties the zinnwaldite becomes greener and richer in beryllium. The beryllium mineral could not be identified. An x-ray diffraction analysis did not positively identify a beryllium mineral but indicated the possible presence of beryl as a minor constituent.

Rubidium but not cesium was identified by spectroscopic analysis of a lithium mica concentrate. Grossularite I = 1.75 ± is present with birefringence similar to quartz or 0.009, very good clear optic axis figures uniaxial negative; at I = 1.74, very low birefringence.

Sample No. 40

Identification of zinnwaldite is tentative; the mineral might be an unusual lithium chlorite rather than lithium mica. Calcite and cancrinite are associated with white fluorescence. Fluorite and grossularite are associated with bright red fluorescence.

Sample No. 44

The amount of beryl does not account for the amount of beryllium indicated by assay. Bismuth was identified spectroscopically associated with galena.

Sample No. 47

A cut of the sample was ground and sieved. The -200 mesh grains were separated into magnetic fractions by means of the Frantz Isodynamic electromagnetic mineral separator.

Magnetic fraction	47-1	47-2	47-3	47-4	47-5
Amperes used	1.5	1.5	1.0	0.5	Hand magnet
	Non-magnetic	Magnetic	Magnetic	Magnetic	Magnetic
Percent of sample	78	3	15	3	1

Aminoffite, a complex beryllium silicate mineral was tentatively identified in samples 47-1 and 47-2.

Sample No. 59

Beryllium is associated with protolithianite, but not with zinnwaldite in the sample.

Sample No. 70

Four magnetic fractions of the specimen were examined.

Magnetic fraction	70-1	70-2	70-3	70-4
Percent of sample	70	5	5	20
Color	White	Green	Brown	Greenish brown

Both green and brown zinnwaldite are present in all fractions. Beryllium is associated with the zinnwaldite but specific beryllium minerals were not detected.

Sample DMEA-1

Beryllium is apparently associated with both lithium mica and quartz concentrates derived from separations made on an electromagnetic mineral separator. BeO was detected spectroscopically in trace amounts only in the heavy side fraction of a vanned concentrate but none was detected in a mineral concentrate having specific gravities in excess of 2.94. No beryllium mineral could be identified. No fluorescence or radioactivity were detected. Al, Ba, Ca, Cu, F, Fe, Ga, Mg, Mn, Mo, Pb, Sr, Ti, Tl, and

V were spectroscopically detected. Traces of an unidentified Zn-Sn blue-black opaque mineral with (?) cleavage occur in the sample.

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