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

BUREAU OF MINES
JAMES BOYD, DIRECTOR

REPORT OF INVESTIGATIONS

ANTIMONY DEPOSITS IN ALASKA

BY

NORMAN EBBLEY, JR., AND WILFORD S. WRIGHT

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By Norman Ebbley, Jr.,[2/] and Wilford S. Wright[2/]

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2/ Mining engineer, Bureau of Mines, Juneau, Alaska.

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INTRODUCTION

During the past decade (1937 to 1947), including the War years of heavy demand in metals, the United States produced about one-eighth the amount of antimony required for domestic use. Realizing the market shortage and the uncertainty of our foreign supply when this nation became involved in World War II, the War Production Board transferred funds to the Bureau of Mines for exploration of antimony deposits in Alaska. The deposits of the Kantishna District of central Alaska (fig. 1) were selected for investigation as a possible source of antimony.

The Stampede mine in the Kantishna District of central Alaska was recognized as a promising stibnite deposit and was selected for exploration. Geological conditions were favorable, and the mine had produced, in the period from 1936 to the spring of 1942, 2,400 tons of concentrate and hand-sorted ore containing about 1,300 tons of antimony.

During the summer of 1941, a field party of the U. S. Geological Survey[3] spent six weeks in mapping an area of approximately 25 square miles surrounding the mine. The mine workings, both surface and underground, were mapped, and the geology was plotted in detail. In the report on this

3/ Donald E. White and W. H. Myers.

work[4/] it was pointed out that the Stampede mine was probably capable of contributing considerably to the supply of antimony.

A preliminary examination was made by the senior author in July 1942, the program described herein was decided upon, and the work was carried on as expeditiously as Alaskan conditions permitted.

The Slate Creek deposit was visited by the senior author July 22, 1942, at which time plans were made to proceed immediately with such exploratory work as would be required to determine whether an ore body of commercial interest existed and to delineate the deposit.

Exploration by the Bureau was handicapped by severely cold weather and the remoteness of the region. Work accomplished during the 1942 season was carried out after McKinley Park Highway was closed because of snow.

During the summer and fall of 1943, a small-scale high-grading operation was carried out by the owner and two helpers. This work consisted of additional trenching and driving a 63-foot tunnel at 16 feet below the old tunnel.

The My Creek antimony prospect 140 miles east of Fairbanks was examined by H. R. Joesting and E. Anderson of the Territorial Department of Mines on October 10, 1942. The owners, contemplating exploration of the deposit by churn drilling, requested the Bureau of Mines to assign a trained sampler to assist in obtaining an accurate sample record of the drilling. Churn drilling began on March 8, 1943, but, owing to adverse flying weather, the Bureau sampler did not reach the property until March 26, 1943. The sampler remained on the property until the exploration ended on April 4, 1943.

An antimony deposit on Boulder Creek, a headwater tributary of Tok River in west central Alaska was staked by a prospector, Sam Gamblin, in the fall of 1940. During ensuing years, the deposit was examined by Henry Joesting of the Territorial Department of Mines and engineers of various active mining companies in Alaska.

In September 1942, this deposit was examined and sampled by Bruce I. Thomas, mining engineer for Gold Placers, Inc., Fairbanks, Alaska. Three days were spent on the work.

In 1942, P. L. Killeen of the Geological Survey made a comprehensive study of antimony ores in the Fairbanks district. In the same year, Killeen examined and reported upon stibnite deposits near Wiseman.

4/ White, Donald E., Antimony Deposits of the Stampede Creek Area, Kamtishma District, Alaska: Geol. Surv. Bull. 936-N, 1942.

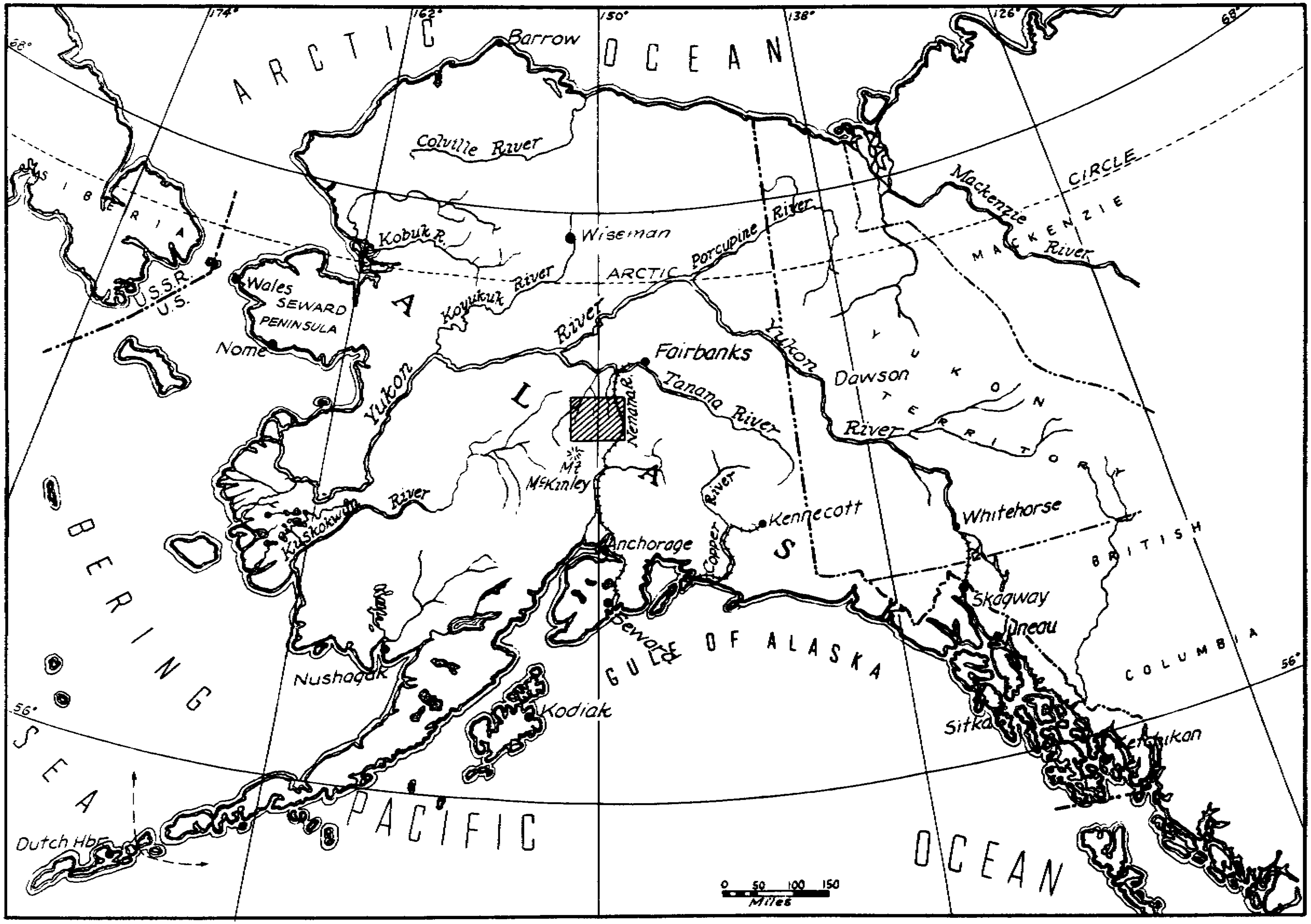

Figure 1. - Index map showing location of Kantishna region.

Mertie examined a stibnite deposit on Kansas Creek in the Bonnifield district 70 miles south of Fairbanks.

The Black Rapids antimony prospect in the Alaska Range, 1-1/2 miles south of the Rapids Roadhouse at mile 233 on the Richardson Highway, was examined by Ralph E. Van Alstine of the Geological Survey.

Robert L. Thorne, mining engineer of the Bureau of Mines, examined the Caamano Point antimony deposit on Cleveland Peninsula, southeastern Alaska, in August 1942.

The Black Mountain antimony deposit on Owhat River, a tributary of the Kuskokwim River, was examined in November 1944 by Burr S. Webber, mining engineer of the Bureau of Mines.

ACKNOWLEDGMENTS

In its program of investigation 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 project as soon as practicable after its conclusion. The Mining Branch, Lowell B. Moon, chief, conducts preliminary examinations, performs the actual investigative work, and prepares the final report. The Metallurgical Branch, Oliver C. Ralston, chief, analyzes samples and performs beneficiation tests.

The Alaska Division, Mining Branch, is under the direction of R. S. Sanford, acting division chief.

Acknowledgment is made of information obtained from B. D. Stewart, Commissioner of Mines, and Henry R. Joesting, Eskil Anderson, and J. C. Roehm, mining engineers of the Territorial Department of Mines.

Information was also obtained from John B. Mertie, Jr., Pemberton L. Killeen, and Ralph E. Van Alstine of the Geological Survey.

Acknowledgment is made to Heine Kenworthy, Bureau metallurgist, who conducted beneficiation tests on the Stampede antimony ore.

The cooperation and assistance of Earl R. Pilgrim, operator and principal owner of the Stampede mine, Ernest Maurer, owner of the Slate Creek mine, Bruce I. Thomas, mining engineer, Gold Placers, Inc., and Howard Sparks, owner of the stibnite deposit on Kansas Creek, are gratefully acknowledged.

STAMPEDE MINE

Location and Accessibility

The mine is at latitude 63° 43-1/2' N. and longitude 150° 24' E., about 110 miles by air southwest of Fairbanks. (See fig. 1.) The altitude is 2,300 feet. Stampede Creek flows into Clearwater River about 3 miles below the mine. Clearwater River is one of the main tributaries of Toklat River, which in turn flows into Kantishna River, and the latter joins Tanana River about 70 miles west of Fairbanks. The Stampede mine area is on the eastern edge of the Kantishna Hills, a small range of mountains separated from the main Alaska Range on the south by McKinley Fork of Kantishna River. The property is 50 miles from Mount McKinley.

Transportation and communication are difficult throughout the year in this part of Alaska. There is no all-year road to the property, and air transport is the only present means of access during the summer months.

During the winter months, or from the latter part of December to late in April, a 50-mile tractor road is maintained over the snow and frozen rivers to Lignite, a station on the Alaska Railroad about 65 miles from Fairbanks. It has been the custom of the operators of the mine to do all freighting during this season, hauling out high-grade ore and concentrate and bringing in supplies for the next year's operation. The tractor freighting costs about $20 a ton, but when back-haul freight is available the cost is reduced to $10 a ton.

If large-scale mining should be undertaken, an access road could be constructed from Mt. McKinley Park Highway down Toklat River to the mouth of Clearwater River and then southwest to the mine. The total distance would be approximately 25 miles, and all of the road would be on the grade of the streams. Construction of this road would permit summer freighting by truck to and from the property. The total truck haul over this route from the mine to the railroad at McKinley Park Station would be approximately 85 miles.

The air field that now serves the mine is about 2-1/2 miles below the property near the confluence of Stampede Creek and Clearwater River. This field is only about 1,500 feet long and is often in poor condition after heavy rains. For a number of years gold-mining activity in the Kantishna district was important enough to permit a Fairbanks air transportation company to operate on a weekly schedule to the area. However, suspension of gold mining for the duration of the war caused the discontinuance of a regular schedule, and thereafter flights were made on a charter basis.

It is possible to obtain fresh vegetables and meat and emergency repair parts from Fairbanks by plane at 10 cents a pound on regularly scheduled flight, or at $85 to $120 for a charter trip.

Stampede has a short-wave radiophone communication schedule twice a day with the Federal Radio Communication Commission at Fairbanks. The primary purpose of this service is the transmission of weather reports, but it can be used for other messages. Radio blackouts are common during the summer, and the schedule is sometimes interrupted for months at a time.

Physical Features and Climate

The topography of the Stampede area is one of mild to moderate relief. The original discovery of high-grade stibnite was made on the crest of a small ridge at an altitude of 2,300 feet. The immediate valleys partly inclosing the ridge drop off approximately 200 to 250 feet, whereas the highest peaks, north and west, rise to 4,500 feet above sea level. The area is isolated from any other mining properties and from the Mount McKinley Highway by a network of small rivers so swift that cross-country travel on foot is dangerous.

Much of the area is covered by a heavy blanket of tundra and brush. There is a good stand of usable timber below the airfield, or about 3 miles north of the mine.

Winters are long and cold and the summers are moderate. Precipitation is light, falling mostly as rain in summer. McKinley Park station has a comparable geographic position with respect to the Alaska Range, and weather statistics assembled over a period of 7 years are as follows:

Maximum temperature, °F.	89
Minimum temperature, °F.	minus 54
Average annual number of days with temperature over 70° F.	41
Average annual number of days with temperature below 32° F.	133
Average annual number of days with temperature below 0° F.	32
Average annual mean temperature, °F.	28.2
Average annual snowfall, inches	59.5
Average annual precipitation, inches	14.38

The rigorous climate would prove no serious hindrance to maintaining year-round underground operations.

Property and Ownership

The property consists of unpatented lode claims, mill sites, and placer claims. The placer claims are a provision for disposal of tailings and extend for 2-1/2 miles below the mine.

Earl R. Pilgrim of Stampede, Alaska, obtained a lease and option on the property from William Taylor and associates in 1936 and later transferred the claims to Morris P. Kirk & Son, Inc., a subsidiary of the National Lead Co. He again acquired control in 1941.

History and Production

The Stampede antimony deposit has been known for many years. The first active mining was in 1915, when about 150 tons of high-grade ore was produced and stock-piled but not shipped. At that time it would have been necessary to haul by dog team north to the Tanana River.

Active operation was begun during the winter of 1936-37 under the management of E. R. Pilgrim, who was then acting for Morris P. Kirk & Son. Mining was limited to high-grade ore, and only hand-sorted material containing over 50 percent antimony was shipped. A permanent camp was constructed during the summer of 1937. A 40-ton mill was constructed in 1939 and operated for about 4 months during the fall of 1939 and spring of 1940. This permitted mining of lower-grade ore, but results were unsatisfactory. The average antimony content of the mill feed was between 10 and 15 percent, and that of the tailing was about 5.0 percent.

After milling was discontinued, mining of the high-grade shipping ore was resumed and continued until March 1941. The high cost of transportation caused operations to cease, as the over-all cost of transporting ore from the mine to Seattle, Wash., was about $35 a ton. Depletion of reserves was a contributing factor.

Mining of high-grade ore was resumed in the winter of 1941-42, and 76 tons was produced and shipped before spring. After rehabilitation, the mill was again operated from August 3 to October 3, 1942, when the water supply was shut off by freezing. Mill feed was obtained mainly by drawing the ore from old stopes and contained about 6 percent antimony. In addition to this material, the mill concentrated about 220 tons of ore with an average antimony content of about 9 percent, produced by the exploratory work of the Bureau of Mines.

Mill recovery during this latter operation was slightly better than before but still unsatisfactory. An average tail sample taken over the period of August 3 to September 13 contained 2.43 percent antimony; the head for this same period contained only 6 percent antimony, and the loss was still more than one-third.

When Pilgrim again acquired control of the property during the winter of 1941-42, operating conditions were particularly difficult; shipping ore had not been developed ahead of extractions, a used mill purchased and shipped to the property failed to give satisfactory recoveries, there was a shortage of labor, and freight rates were high. For these reasons mining of mill ore became economically hazardous, and the operation became one of "high-grading" the richer portions of the deposit.

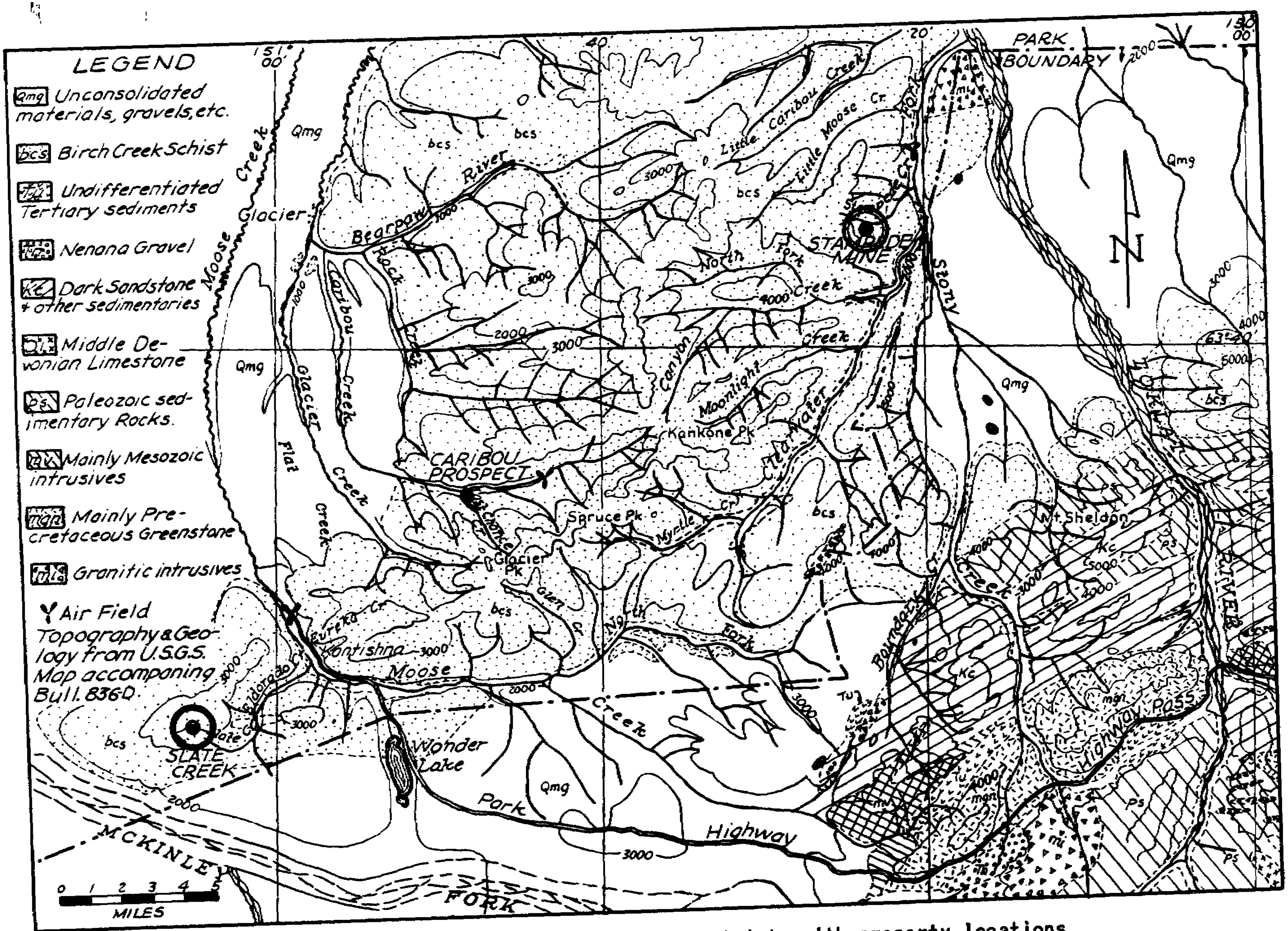

Figure 2. - Sectional map of Kantishna district, with property locations.

The total production of ore and concentrate from the mine for the years preceding Bureau exploration is shown in the following table.[5]

Year.	Ore and concentrate, tons	Antimony		Value[1]
		Percent	Tons	
1937	873.67	55.01	481	$147,667
1938	426.73	52.00	222	54,834
1939	211.91	49.68	105	25,956
1940	293.83	52.16	153	42,840
1941	582.90	53.47	312	87,360
1942[2]	250.00	55.00	137	41,000
	2,638.64	53.44	1,410	399,657

1/ Totals computed by using average price of antimony for year.
2/ Estimated.

The exploratory work of the Bureau of Mines at Stampede was begun in early August and completed in December 1942. In the early part of 1943, Pilgrim followed up this work with mining and shipping of high-grade antimony ore and sinking the Mooney winze 25 feet. Mine operations were discontinued after the ore shipments in the spring of 1943, not for lack of ore but because supplies, equipment, and miners were hard to obtain.

In the summer of 1946, Pilgrim traced the Stampede vein north across the valley about 1,200 feet from the mine. He located the outcrop and found antimony float ore farther up the hill along the strike. A new adit has been opened 15 feet on a high-grade antimony vein 3 to 15 inches wide. Plans at this time (February 1947) are to continue this new adit and to drive the lower adit (elevation 2,030) southwest to reach a point below the projected position of the Nesse winze.

Ore Deposits[6]

The rocks of the Kantishna hills are mostly schists of various types known as the Birch Creek schist. Locally these schists are either micaceous or quartzitic and include a considerable percentage of chloritic members, limestone, and phyllite. The Birch Creek schist is generally assigned to the pre-Cambrian. (See fig. 2.)

The stibnite deposits as well as the gold lodes generally occur in areas where quartzitic members constitute the major part of the rock formation. This is true of the Stampede deposit, where beds of silicious schist, grading into a schistose quartzite, predominate in the areas containing minable ore bodies. Several prominent outcrops of the schistose quartzite are exposed along the ridges above and west of the mine.

5/ From mine records.
6/ The Geology of the Stampede mine is completely described in Geol. Surv. Bull. 936-N.

Approximately 4 miles northeast of the Stampede mine the Birch Creek schist has been intruded by a light-colored igneous rock exposed as a large outcrop along a flat ridge. This intrusive is in large part obscured by gravel-covered terraces and vegetation, but scattered float indicates that its surface occupies an area roughly 2 miles in diameter.

As observed underground at the mine, the schist has been warped to such an extent that it is generally difficult to distinguish the bedding. In general, the folds strike northeast and plunge in the same direction; however, small localized folds are so numerous as to partly obscure the general trend.

The area embraced by the surface and underground workings of the mine has been extensively faulted. There are two strong faults bearing roughly east and west, one of which carries the antimony. Approximately at right angles to these are two well-marked faults (Nos. 1 and 2), and a third transverse fault (the Swanson) displaces the vein near the east end of the mine. In addition to these, the district is crisscrossed by minor faults of various bearings and dips.

Faults 1 and 2 and the Swanson have displaced the vein and caused difficulty in exploration and mining. They have given rise to the belief that several veins were present and to the use of different names for what is really one vein.

At the western end of the property, where the first mining occurred in the large deposit known as the Glory-Hole ore body, a well-marked fault structure, called by White the Stampede fault, forms the hanging wall of the ore body. It is probable that this fault was a factor in the localization of enrichment at this place.

This fault zone is 32 feet wide where exposed in the glory hole and where intersected by trench 1, 250 feet west of the main shaft. The material within the shear zone, in addition to abundant gouge, consists of decomposed brown, yellow, and white schists, light-colored quartz and quartzite, and bands of dark slate that have a low dip to the west.

A second strong fault very similar in appearance to the Stampede fault was found in two southerly crosscuts from the lower adit level and in one from the Libby intermediate level.

In appearance, the Stampede and this latter fault are similar, having widths of 30 feet or more and containing much gouge and decomposed schist, which are evidence of considerable movement. The oxidation stain, typical of the fault zone on the surface and in the upper level, are absent in the fault found in the lower levels, where the brownish and light-colored decomposed schists are missing and the entire structure is composed of dark-colored unoxidized material. A few minute crystals of pyrite and stibnite were found in both structures.

The fault found in the lower levels dips about 50° to the north and strikes approximately N. 75° W., differing in these respects from the Stampede fault; however, these discrepancies are not considered conclusive proof that these structures are not the same.

The vein occupies a fault zone that has been traced from the glory hole to transverse fault No. 1, a distance of about 220 feet from the main shaft. It is displaced to the north at the fault, and east of this the outcrop has been traced for about 250 feet. Trenching farther to the east failed to find the outcrop.

The outcrop of the vein swings somewhat to the northeast and separates gradually from the outcrop of the fault. In the upper level workings, approximately 90 feet below the glory hole, the fault and vein are almost parallel and the bearing of both is nearly east-west. On this level the vein was followed for approximately 250 feet between the bottom of the main shaft and the winze driven from the surface ore body east of fault No. 1.

The vein joins the Stampede fault on the surface immediately west of the Glory-Hole ore body and near the main shaft. Trenching indicates a merging of vein and fault from the glory hole to the west.

The Stampede fault carries no values to the east of the merger of vein and fault. This may indicate that formation of the Stampede fault preceded formation of the vein.

Transverse fault No. 1, which apparently had a rotational movement, cuts the vein 220 feet east of the main shaft. It displaces the vein 40 feet to the north on the surface and approximately 80 feet to the north on the upper level horizon but does not appear to alter the strike of the vein materially.

Transverse fault No. 2 is found in the upper level, where it intersects the vein approximately 440 feet east of the shaft. At this place the horizontal displacement to the north is slight, whereas there is an abrupt change of strike from north 60° east to north 30° east.

The third of the larger transverse faults is the Swanson, which was encountered in the Mooney drift eastward from the lower tunnel. It displaces the vein 20 feet to the north at this point; nothing is known of its other effects.

All of these faults dip to the east - No. 1 at about 47°, No. 2 at about 83°, and the Swanson at about 65°.

In addition to the principal fault structures, there are many minor faults of varying strike and dip. In general, the effect of these is negligible.

The only dike encountered was found in the upper and 50-foot levels. This is a porphyritic andesite dike that strikes N. 50° W. and dips 40° to the northeast. In the upper level tunnel the dike is cut about 100 feet from the portal and is 5 feet thick.

The position and character of the faults point to the occurrence of two main periods of tension. The first resulted in the formation of the Stampede fault and the vein fault, though the two apparently were not formed at the same time. The second resulted in the formation of the three major transverse faults and probably many of the minor ones. Nothing now known definitely fixes the age of the minor faults or points to any major direction of stress.

The effect of the transverse faults upon the deposition of stibnite is problematical. It seems likely that they displaced the vein but did not affect its character otherwise. This lack of influence is indicated by the absence of relation in position between the enriched portions of the vein and the faults. In some instances ore shoots have been found in the vein close to and on the hanging walls of transverse faults, but frequently the vein was barren where cut by similar faults, and in many instances ore bodies occurred at considerable distances from the faults.

The Stampede fault may have been responsible for the localization in the large deposit, which was mined through the glory hole. This could have resulted from the damming of the mineral-bearing solution at the junction between the vein and the fault. Also, the brecciation caused by faulting, which here occupies the space between the hanging wall of the fault and the vein, may have supplied channels for the circulation of solution.

Excepting the mass mined at the glory hole, the ore bodies appear to be a replacement along a fault. Only one vein has been found, although complex cross faulting and warping have resulted in the apparent existence of several veins and in the use of different names. This vein, the Stampede, varies greatly in width, antimony content, and appearance in different parts of the mine. The strike in the western part of the mine is east-west or slightly to the northeast; east of fault No. 2 it is approximately northeast, and in the Mooney workings it is approximately parallel to its strike where originally found in the east end of the mine; however, in the east end of the Mooney workings it swings rapidly through the entire northeast quadrant to N. 50° W. The dip varies from 75° south to about 40° west, the latter at the extreme east end of the mine.

Where the vein is intersected by normal transverse faults it is offset to the north. As the vein dips to the south and the faults to the east, the portion of the vein on the east side of any fault is higher structurally than that on the west side; consequently, it is farther to the north at the same elevation. There are several such faults in the Mooney workings at the east end of the mine. Most of them have little effect, but the Swanson fault displaces the vein 20 feet to the north.

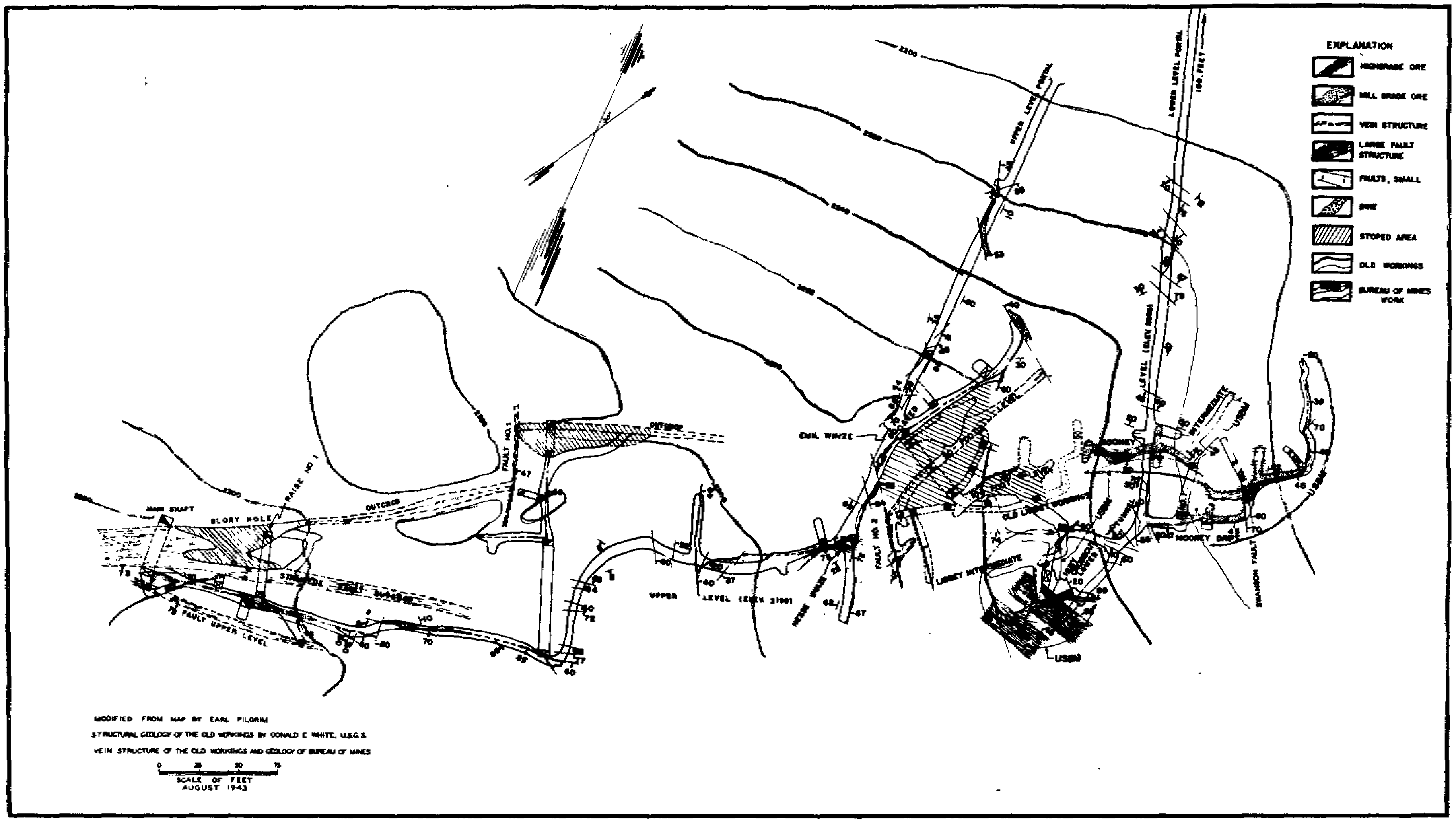

Figure 3. - Composite map of surface and underground at Stampede antimony mine, Kantishna district, Alaska.

The Bureau of Mines work has shown that the vein encountered in the Mooney intermediate drift is, in fact, a continuation of that found in the old Libby intermediate; thus, there is an unbroken vein structure more than 150 feet long at this level.

The hanging wall of the vein is marked by a band of gouge through almost its entire extent. The footwall is a quartzitic schist, the fractures of which served as feeders for the ascending solutions. In some places fine-grained stibnite occurs in the gouge, and it is these deposits that constitute the high-grade portions of the vein.

The remainder of the vein, in some places over a width of 20 feet, derives its principal value from narrow veinlets of almost pure stibnite shot through the brecciated zone of the footwall. It was observed that the lower-grade zone was wider and contained more stibnite where the thickness of stibnite along the hanging wall was greatest. For this reason it is concluded that the vein structure acted as its own feeder.

Figure 3 is a plan of the mine workings showing principal faults and geologic features.

A description of the ore bodies from west to east is as follows:

The Surface or Glory-Hole ore body was 65 feet long and 25 feet wide and was mined to a depth of 45 feet below the outcrop. The upper 25 feet was almost pure, high-grade stibnite, containing about 60 percent antimony. According to reports, approximately 700 tons of antimony was recovered from this ore body. The grade of the ore deteriorated with depth until the deposit became subcommercial at 45 feet below the outcrop. In each direction along the strike, the high-grade ore was gradually replaced by quartz and quartzite schist until it was too low in grade for hand sorting. The narrow, high-grade, hanging-wall stringer of stibnite that still remained in the bottom of the glory hole does not appear in the vein on the level below, where the vein is narrow.

The upper level below this ore body has been sampled for a length of 250 feet and found to have an average width of 3.9 feet and an average antimony content of 2.06 percent. The vein has not been explored below the upper level in this part of the mine.

A few tons of mill-feed ore were mined above raise No. 1 from the upper level just east of the Surface ore body. This ore continued for only a short distance above the level.

The unnamed ore body was approximately 220 feet east of the Surface ore body. Here a narrow deposit was mined from the surface to a depth of 25 feet. This ore body was immediately east of transverse fault No. 1 and extended along the strike of the vein for approximately 80 feet. There is no apparent reason to believe that the fault had any relation to deposition of ore. No accurate figures are available on the tonnage extracted, and the opening is caved and inaccessible.

The Nesse winze ore body 450 feet east of the Surface ore body and just below the upper tunnel level produced approximately 80 tons of ore containing 55 percent antimony. This area is now completely caved, but it is reported that 10 inches of high-grade ore still remains in the bottom of the winze. The winze was sunk to a depth of 25 feet below the level, and a narrow stope was mined on both sides. On the east side of the winze the ore was mined to the footwall of transverse fault No. 2. A raise on the vein from the upper level 15 feet west of the winze failed to encounter any ore, the vein consisting mainly of quartz and brecciated schist with scattered spots of antimony.

The Emil winze ore body was found immediately east of transverse fault No. 2, between the upper and lower tunnel levels. The strike ranged from N. 30° E. on the upper level to N. 50° E. in the old Libby intermediate level below. The ore was mined extensively, and the stope is now inaccessible because of caving of the soft hanging wall. It is reported that approximately 500 tons of antimony was obtained from this stope, mainly from high-grade stibnite and partly from mill-grade ore. The high-grade, hanging-wall, stibnite rib attained a width of 3 feet in a few places near the winze. The owner states that a considerable amount of high-grade ore and a large tonnage of mill-grade ore remains in the caved area; however, the profitable recovery of this ore is doubtful because of the caved condition of the opening, which would make it necessary to drive new winzes to reach the more or less isolated segments of the vein.

The block (between the old Libby intermediate and the 50-foot level) is far enough east of the main Emil winze workings to be unaffected by the caved condition and can be developed readily by short raises from the lower tunnel level.

Farthest to the east and on the lower tunnel level is the Mooney ore body.

This vein segment is terminated on the west by two faults that were encountered in the tunnel. Probably these faults are local, as they are not found in the intermediate drift above. They strike N. 35° W. and dip 60° to the northeast.

From the lower tunnel, the Mooney drift extends eastward for 60 feet along the vein. Here the Swanson fault causes an offset of 20 feet to the north. East of the Swanson fault the vein strikes N. 55° E. for 40 feet, where it swings sharply, but without a break, to the left. Within a distance of about 25 feet, the strike becomes N. 50° W. For the remaining distance of 45 feet to the face of the drift, the strike is N. 25° W. and the dip 39 to 50 degrees to the northeast.

In several places on the hanging-wall side of the vein there are ore bodies 20 to 24 inches wide with an average antimony content of 60 percent.

East of the Swanson fault and in the short crosscut driven 20 feet westward from the top of Mooney raise No. 2, the mill-grade part of the vein is 18 feet wide and has an average antimony content of 9.98 percent.

The Ore

The antimony content of the Stampede vein covers a wide range in different parts of the mine. The footwall is not structurally defined, and the practical determination of a footwall is a matter of economics, depending on the cost of production and the profit derived from the concentrate. In the upper workings, many of the high-grade shoots had an antimony content of 65 to 69 percent. The high-grade portions of the ore bodies found in the lower levels have an antimony content of 59 to 63 percent. The stibnite found in the upper workings is generally coarsely crystalline and relatively free from gangue. On the lower levels, extremely fine-grained stibnite crystals are interlocked with very thin transparent sheets of muscovite and contain minute inclusions of quartz. A binocular microscopic study indicates that fine grinding may not entirely liberate the stibnite from the muscovite, and a portion of the antimony may not be recoverable.

The principal antimony mineral in the Stampede deposit is stibnite, Sb_2S_3, antimony tri-sulfide. Kermesite, Sb_2S_2O, and valentinite, Sb_2O_3, in which oxygen replaces a part or all of the sulfur, are present in unimportant amounts.

Kermesite usually occurs as incrustations on the stibnite and is rare in the lower workings. Valentinite is present in many forms - as crust, cavity fillings, cementing material, and minute crystals. This red antimony oxide is present in many of the high-grade boulders found in the stock pile below the old glory hole. A small amount of yellow oxide, probably stibiconite, $Sb_2O_3 . Sb_2O_5 . nH_2O$, and the H_2O-free oxide cervantite have been observed in the old surface workings. These oxides are not commercially important in any part of the mine.

The principal gangue constituents, in order of abundance, are quartz, muscovite, pyrite, and chlorite. Pyrite is present as minute scattered crystals throughout the vein and can generally be found sparsely disseminated in the adjacent country rock. In a few instances pyrite comprises the chief mineralization in the vein, as near the west end of the upper tunnel level. The pyrite is rarely associated with the stibnite.

Quartz, the principal gangue constituent, occurs as veinlets, lenses, and crushed zones in the vein. Minute megascopic particles of quartz were found within boulders of what appeared to be pure stibnite. In the Mooney workings, most of the massive fine-grained stibnite contained particles of quartz so small as to require microscopic examination for determination. In a few instances minor secondary quartz crystallization was observed in the upper workings.

Other minerals found, though in insignificant quantities, are arsenopyrite, marcasite, sphalerite, chlorite, and calcite. Qualitative spectrographic examination of a composite sample gave the following results: major constituents, silicon and aluminum; intermediate constituents, antimony and iron; minor constituents, in order of importance, calcium 1 percent, magnesium 1 percent, potassium 1 percent, titanium 0.5 percent, barium 0.1 percent, zirconium 0.1 percent, and traces of strontium, vanadium, zinc, arsenic, sodium, copper, boron, chromium, lead, manganese, nickel, cobalt, and silver.

Chemical analyses indicate that no objectionable components are present in sufficient quantity to detract from the value of the ore. Pilgrim states that a sample cut from a concentrating table contained about 50 percent pyrite and $60 a ton in gold. Assays of samples from pyritic zones underground, however, show very low gold content, a fact that indicates the gold is associated with the quartz rather than with the pyrite.

Exploration by the Bureau of Mines

During the preliminary examination, the following conditions were noted: Virtually all of the developed high-grade shipping ore and better-grade mill feed had been mined. Development on the lower levels had been discouraging. The numerous faults, the lack of continuity of the vein, and a narrowing of the vein with depth, made the estimation of ore reserves difficult. The method of "high-grading" the richer ore, with inadequate timber support, had resulted in caving of the stopes.

With regard to methods of exploration, it was decided that best results could be obtained from underground exploration in the form of drifts, crosscuts, raises, and winzes; and it was thought that valuable information could be obtained from such work. The presence of soft schists and numerous wide fault zones and the character of the ore mineral and its irregular occurrence made the use of core drilling for the immediate purpose of the investigation unpromising, though it could be used for short holes for the determination of structural conditions.

The Stampede vein had never been traced on the surface in either direction along its strike except in the immediate vicinity of the glory hole. A few bulldozer trenches along the projection of the vein were thought to be advisable, and these were begun in August.

Trench 1, 260 feet west of the main shaft, exposed the vein in the center of the Stampede fault, indicating a merging of these two structures.

The following method was used in sampling trenches: A hand trench 18 by 18 inches was excavated in the bottom of the 11-foot bulldozer trench, crosscutting the shear zone at right angles for its entire width. (See fig. 4.) A slice 1 inch thick and extending to the bottom of the hand trench was then taken from one wall. Each sample ended at any point where a change in the structure occurred. These samples, generally weighing 100

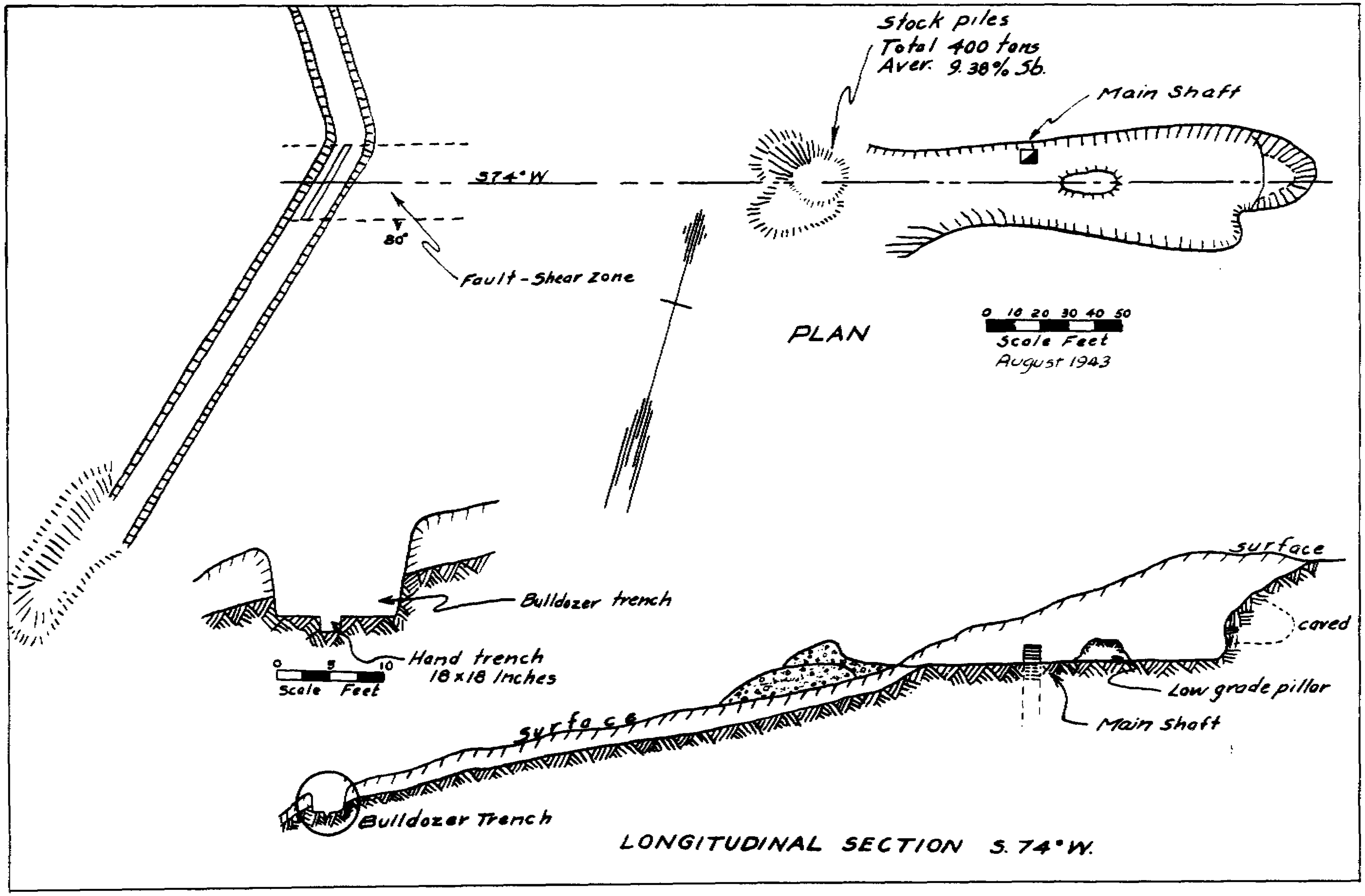

Figure 4. - Trench No. 1, open pit and glory hole.

to 200 pounds, were crushed and quartered to approximately 20 pounds each. Results of sampling trench 1 are as follows:

Sample	Length cut, feet	Antimony, percent	Remarks
STA-1-1	5.0	0.60	Brown, decomposed, clayey schist.
STA-1-2	2.5	2.5	Quartz, quartzite, and schist.
STA-1-3	11.0	0.67	Decomposed white quartz and schist.
STA-1-4	3.0 (diagonal)	23.65	1- to 4-inch band, high-grade rib only, not representative.
STA-1-5	3.0	6.00	General of No. 4, true sample.
STA-1-6	4.0	1.59	Decomposed quartzite and schist.
STA-1-7	2.0	3.91	Hard quartzite, high-grade 1 inch wide.
STA-1-8	10.0	0.47	Decomposed red-gray schist.

Three other trenches, 2, 3, and 4, were attempted farther west on the surveyed projection of the Stampede fault-vein but were not successful in reaching bedrock because of the steep slopes and frozen ground. Trenches 5 and 6 were excavated to bedrock several hundred feet eastward from the glory hole, across the calculated projection of the Stampede vein, but the vein was not found, possibly because of displacement by faults. Trenching is summarized as follows:

Trench	Length, feet	Average width, ft.	Average depth, ft.	Cubic yards
1	240	11	5	490
2	150	11	4	245
3	150	20	3	330
4	100	11	6	245
5	75	11	3	90
6	100	11	3	120
Total ...				1,520

Underground Exploration

Extensive rehabilitation was necessary before underground exploration could be started by the Bureau of Mines. As no appreciable underground work had been done for over one year, the mine track, timber, and equipment were in poor condition. Inadequate timbering and water from heavy rains, which entered the mine through the glory hole, had caused complete caving of many of the old stopes and drifts, resulting in an almost complete loss of the upper part of the mine. Many tons of fine muck and slime carried by water from the upper workings had to be removed from the lower tunnel.

The underground exploratory program was designed to delimit, where feasible, by one drift and one raise, each segment of the ore body bounded by any set of transverse faults. This work was carried on from the lower tunnel level and was confined to the eastern part of the mine. The work continued without interruption until December 1942. The total length of underground excavation by the Bureau was 740 feet.

Broken material or car samples were taken from each round blasted, regardless of whether from drifts on the vein or crosscuts through country rock. This policy was adopted so that permanent assay maps would be on record for future consideration. These samples, averaging about 150 pounds each, were crushed, quartered to 15 pounds, and duplicate samples were retained. Approximately 15 percent of the duplicates were sent for check analyses. Additional samples were taken of all accessible underground vein structures and surface stock piles. Locations of samples are shown in figures 5, 6, 7, 8, 9, 10, and 11.

Development

The Stampede mine has passed through four phases of development, as follows: first, the open pit or glory hole; second, the upper tunnel level; third, the lower tunnel and three intermediate levels; and fourth, the new development of the eastern part of the mine by the Bureau of Mines.

Development and exploration are summarized, in terms of feet, as follows:

Stage	Drifting	Cross-cutting	Raise and winze	Total	Remarks
First ...	75	25	100	200	Mainly open pit.
Second ..	730	500	405	1,635	Includes drifts on faults.
Third ...	550	590	510	1,650	Do.
Fourth ..	397	172	171	740	Bureau of Mines work, 1942.
Totals.	1,752	1,287	1,186	4,225	Does not include stoping.

In the exploratory work by the Bureau of Mines, 1,420 tons of ore was produced. Of this amount, 220 tons was treated before the mill stopped operation, and the remaining 1,200 tons was stockpiled on the mine dump. A total of 753 cars of waste was removed from the headings, and 45 cars of waste was removed during rehabilitation.

The mining procedure in the past has been to extract the high-grade stibnite rib generally found on the hanging wall of the vein where it was thick enough. This "high-grading" was usually done in winter when the ground was frozen and the mine openings would stand without timber. Unfortunately, this system usually resulted in the caving of the soft hanging wall during the warm summer months and often caused the loss of the remainder of the vein. In many areas a considerable tonnage of good mill ore was lost.

Beneficiation Tests - Mill Tailing

The ore-dressing report of tests on a sample of the mill tailing showed that stibnite was the principal antimony mineral, but a small amount of antimony was present as oxides. The stibnite occurred in massive form and to a small extent as tiny flattened grains between muscovite sheets.

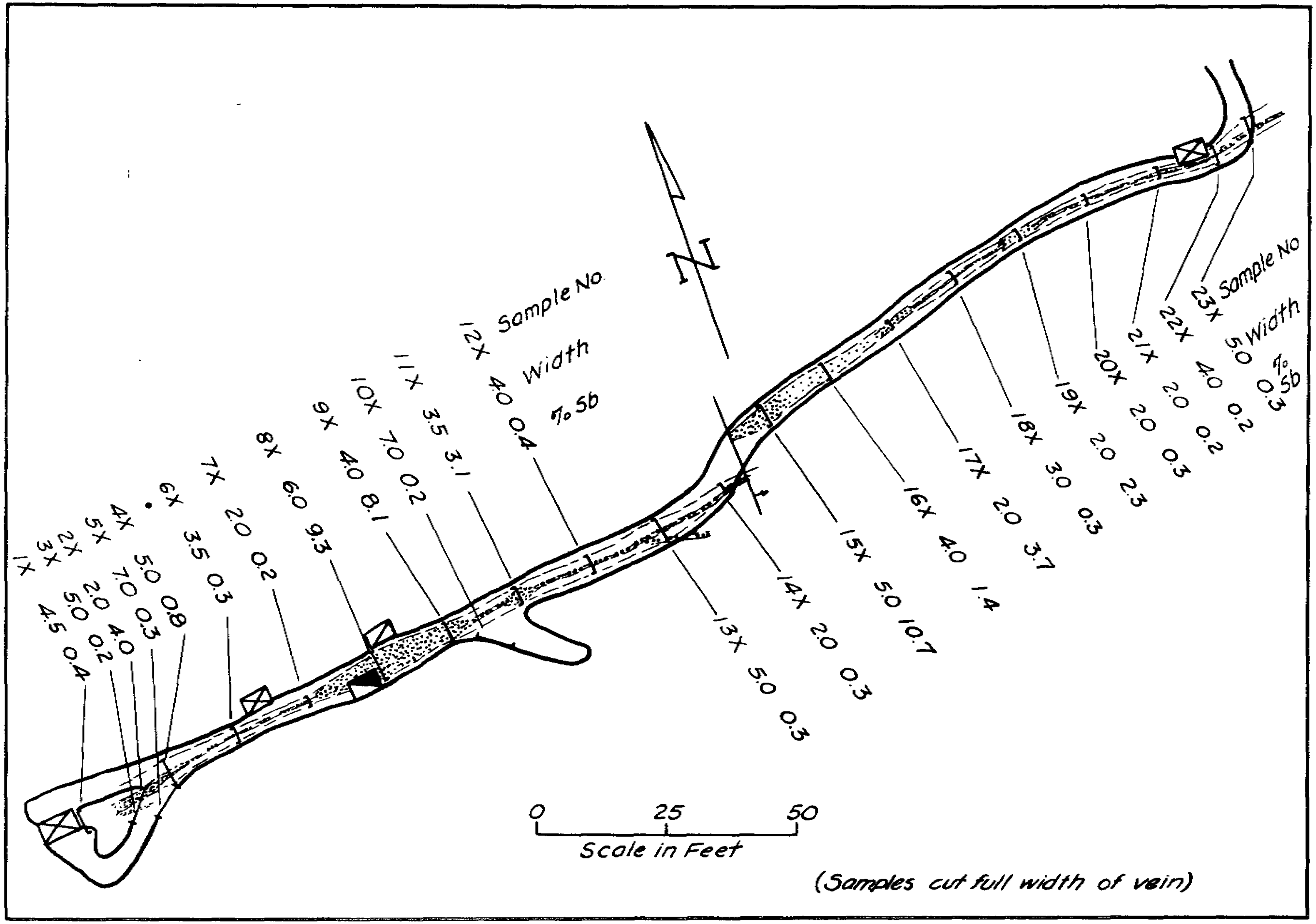

Figure 5. - Assay plan. Section old workings. Upper level drift.

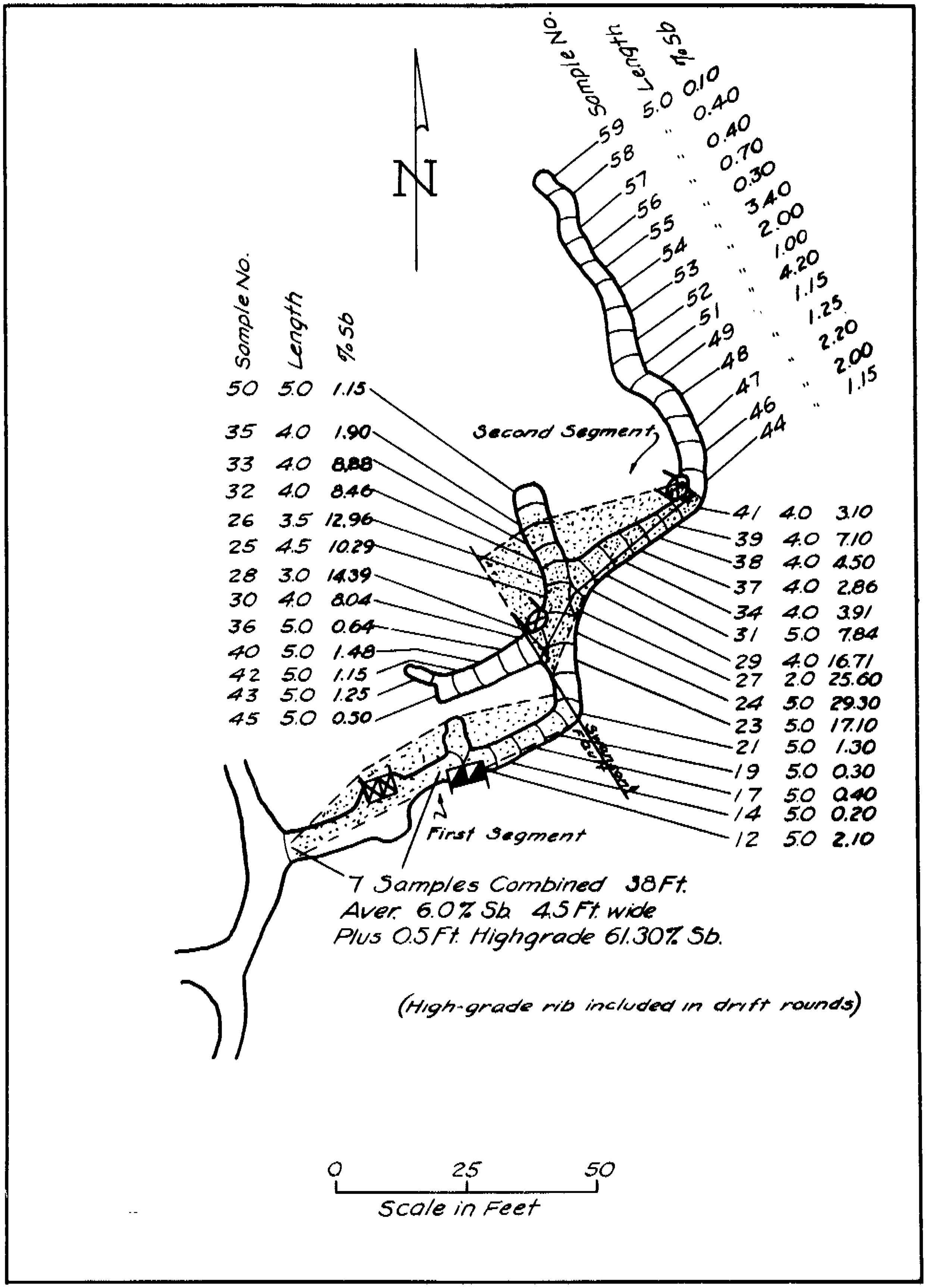

Figure 6. - Assay plan, lower level Mooney drift.

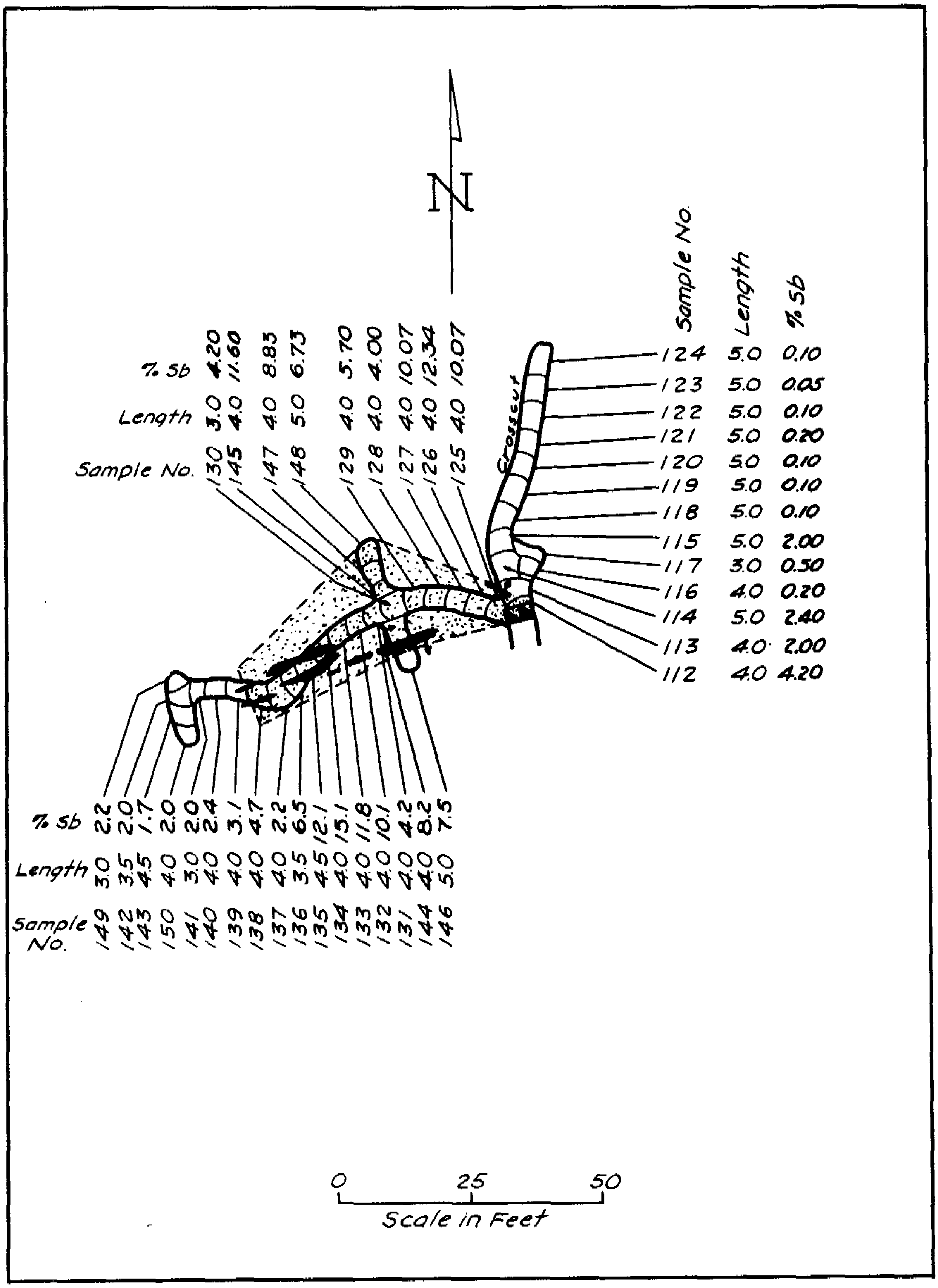

Figure 7. - Assay plan, Mooney raise No. 1, intermediate.

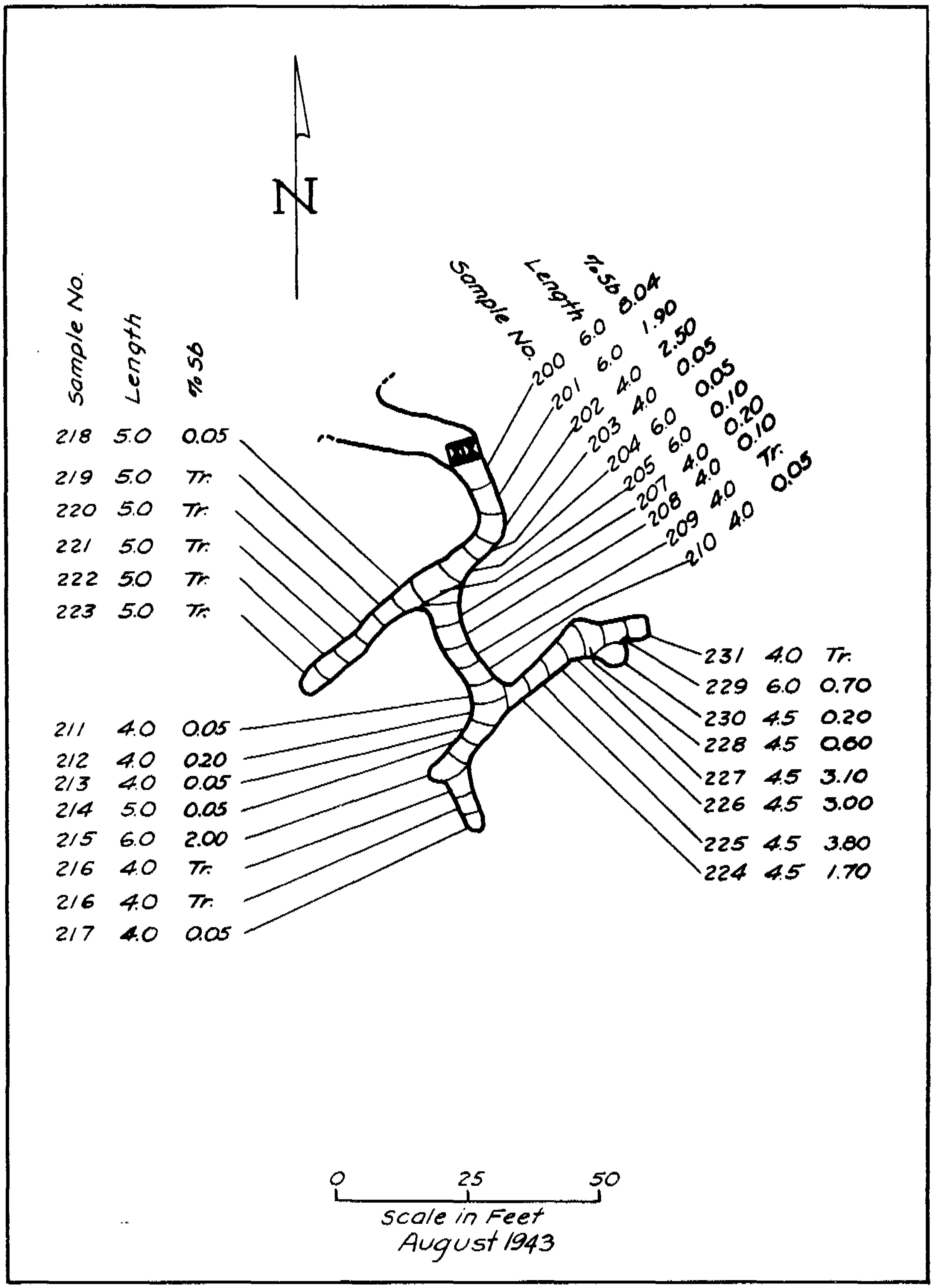

Figure 8. - Assay plan, new Libby intermediate.

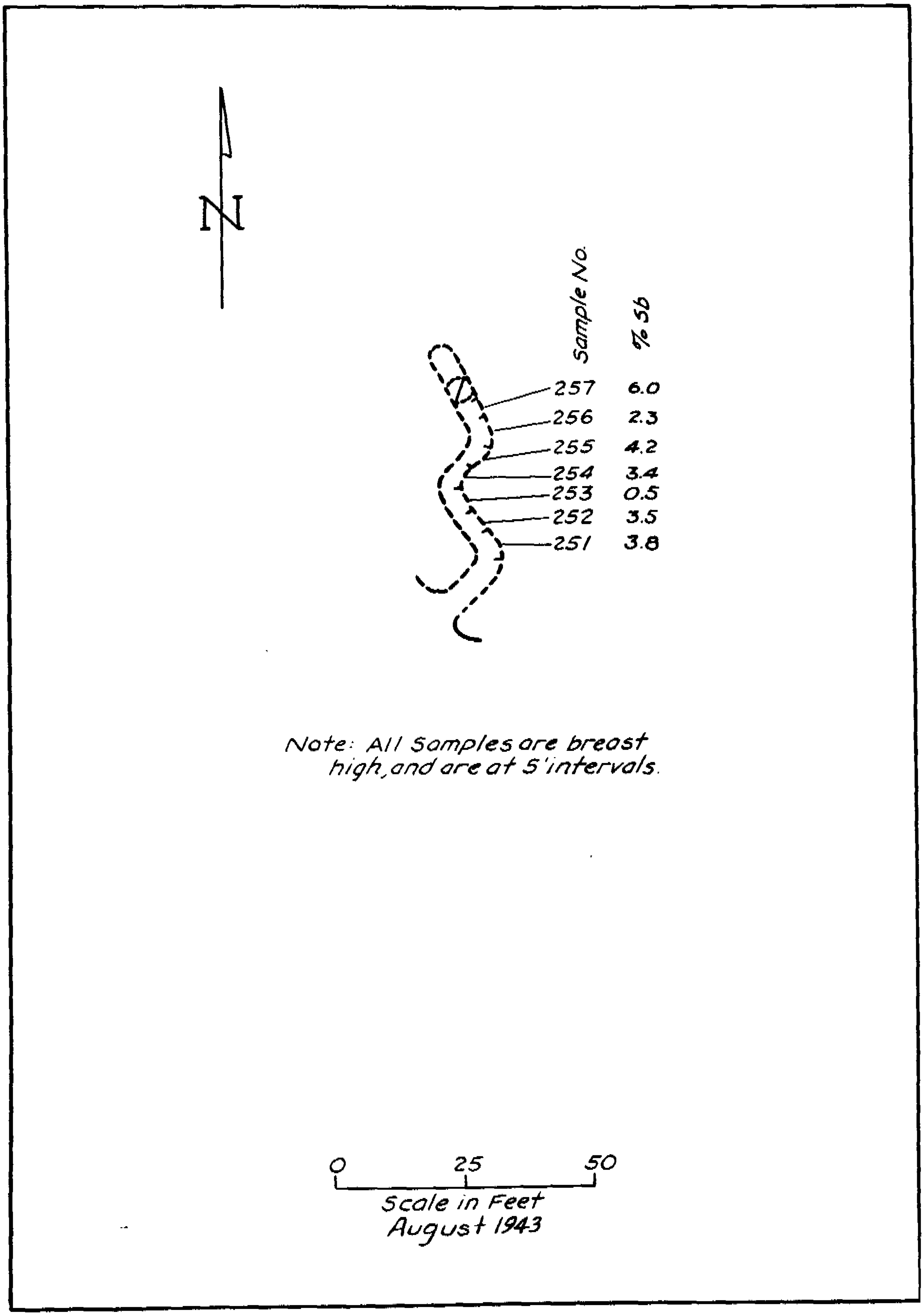

Figure 9. - Assay plan, old Libby intermediate.

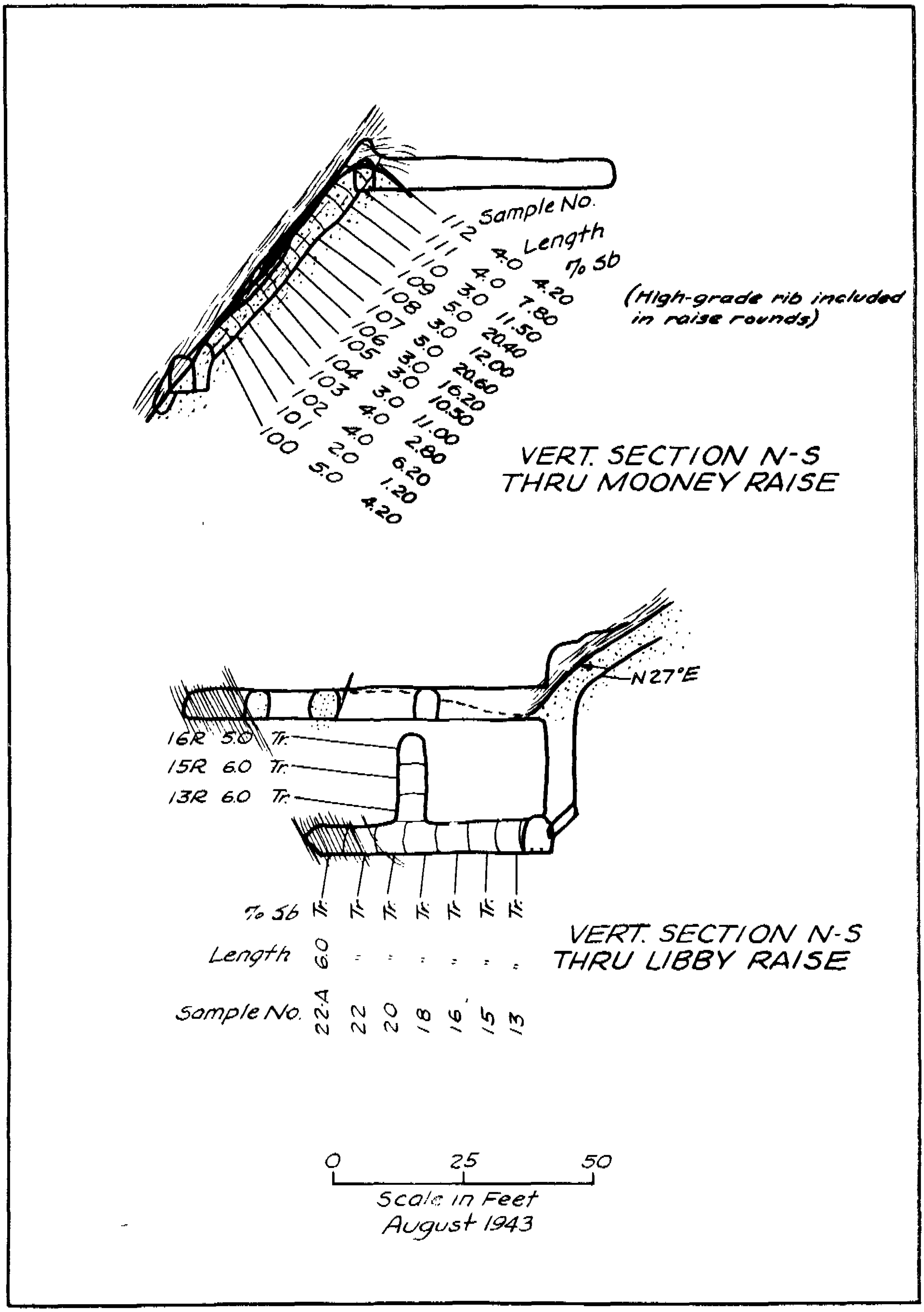

Figure 10. - Assay map of vertical sections.

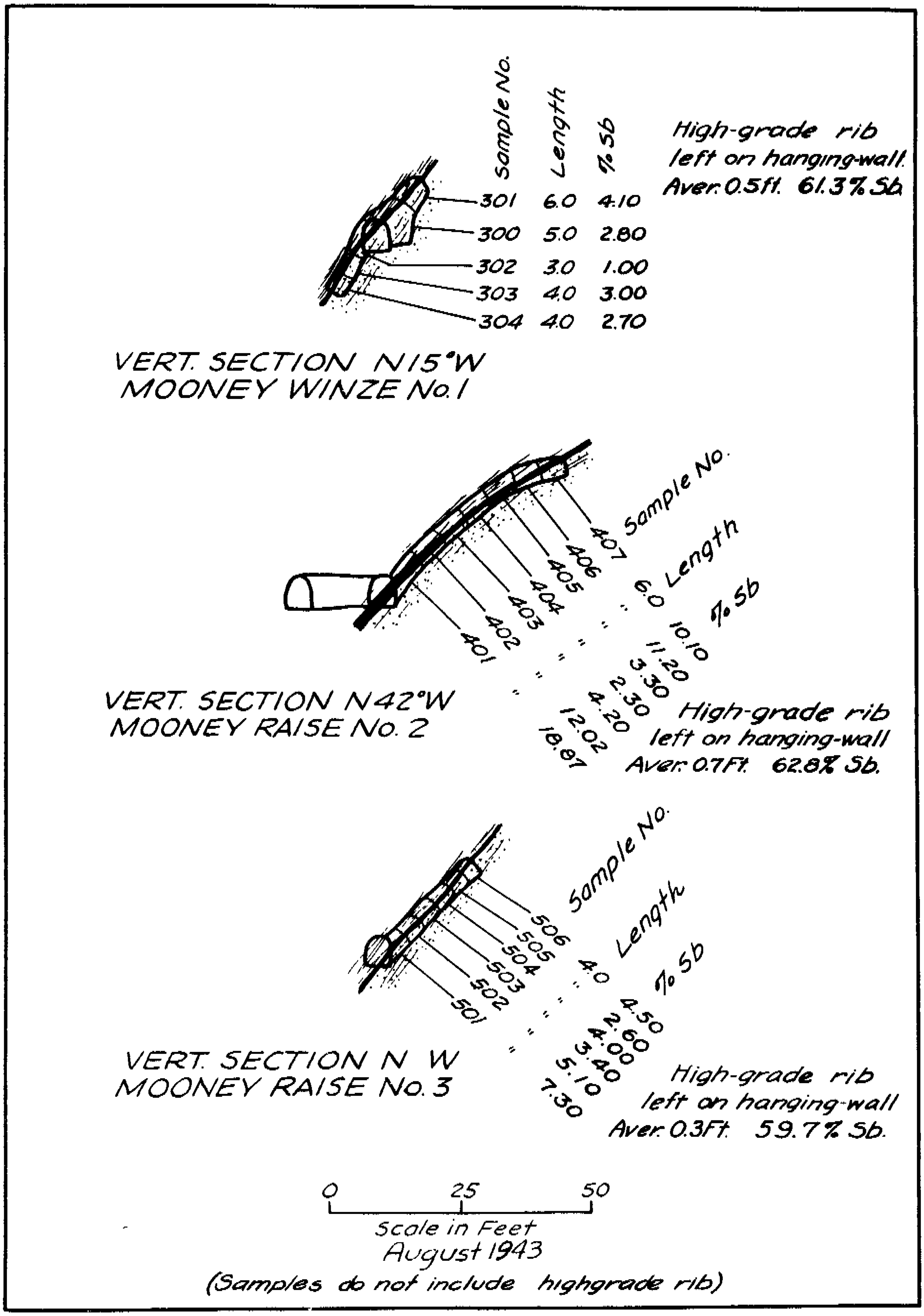

Figure 11. - Assay map of vertical sections.

The oxides were soft and crumbly. Quartz was the predominant gangue mineral, with smaller amounts of muscovite and minor amounts of chlorite and pyrite. The pyrite was not closely associated with the stibnite.

Microscopic examination indication that minus 10-mesh grinding liberated the bulk of the massive stibnite, and that very fine grinding probably would not liberate much of the stibnite occurring between the muscovite lamellae. The antimony oxides probably would be slimed in the grinding procedure.

Analysis of the sample treated in the metallurgical test showed the following percentages: antimony 5.9, iron 1.4, silica 70.7, and insoluble 82.0.

The highest grade of concentrate obtained in testing this material was made by flotation, but recovery was not as high as was obtained by a combination of tabling and flotation. The flotation concentrate contained 57.1 percent antimony, 1.0 percent iron, and 4.7 percent insoluble. Antimony recovery was 64.8 percent. A low-grade scavenger product that might be refloated successfully in a continuous circuit also was isolated, but it is doubtful whether the additional recovery would compensate for higher cost of operation and equipment.

Tabling of the mill-tailing sample recovered 70.2 percent of the antimony as a product containing 44.6 percent antimony, 3.1 percent iron, and 26.0 percent insoluble. Flotation of the table middling and slime recovered 41.7 percent of the antimony in these products as a concentrate containing 56.3 percent antimony, 0.6 percent iron, and 6.4 percent insoluble. Overall recovery by tabling and flotation was 76.4 percent of the antimony in the mill tailing, and the combined concentrate contained 45.5 percent antimony, 2.9 percent iron, and 24.5 percent insoluble.

Float-and-sink tests indicated that a small amount of the antimony could be recovered by jigging ore as coarse as minus 4-mesh.

Beneficiation Tests - Run of Mine Ore

Ore-dressing tests were made on a representative sample of ore from the old stopes in the Stampede mine, which was lower-grade than average mine-run before stoping. Microscopic study indicated that most of the massive stibnite would be liberated at 10-mesh, whereas very fine grinding would not satisfactorily free the stibnite between the lamellae of muscovite. The sample treated showed the following analysis, in percent: antimony 6.0, iron 2.4, silica 68.7, insoluble 83.5.

Jigging, tabling, and flotation recovered 79.8 percent of the antimony as a combined concentrate containing 41.4 percent antimony, 6.5 percent iron, and 17.0 percent insoluble.

Flotation was unsatisfactory on the crude ore except with regard to the grade of concentrate produced. The grade was 53.0 percent antimony, but the recovery of antimony was only 65 percent. Antimony oxides were not recoverable by this method.

Jigging produced a tailing from which very little more antimony was recoverable except by flotation.

The existing flow sheet and a suggested revision are shown on figures 11-A and 11-B, respectively.

SLATE CREEK MINE

Location and Accessibility

The Slate Creek antimony deposit is about 3 miles from the mouth of Slate Creek, which drains into Eldorado Creek 4 miles above the confluence of Eldorado and Moose Creeks. Moose Creek is a tributary of the Kantishna River, which is one of the major rivers draining the Mount McKinley area and which flows north into the Tanana River. The outcrop lies at longitude 151° 03' west and latitude 63° 25' north, approximately 30 miles north of Mount McKinley Peak. The location is shown on figure 2.

The antimony deposit is approximately 7-1/2 miles from the Mount McKinley Park Highway at a point about 90 miles from McKinley Station on the Alaska Railroad. There is no connecting road to the property, and air transportation is the only means of access in winter. Suitable access roads can be constructed easily.

Equipment for preliminary prospecting and developing could be freighted by tractor up the Eldorado Creek bottom to the mouth of Slate Creek. From this point an easy ridge grade could be followed to within half a mile of the deposit, from whence an almost level grade leads to the site of the present workings. For any extended development or large-scale production it would be advisable to construct a suitable road for the entire distance. However, for present purposes not more than 1 mile of side hill and roughing-out road would be necessary.

The Red Top landing field, 2 miles below the mouth of Eldorado Creek and 9 miles from the antimony prospect, has been utilized with only fair success by chartered planes.

Physical Features and Climate

In general, the area of Eldorado-Slate Creek is one of mild to moderate relief. Altitude at the mouth of Eldorado Creek is approximately 1,500 feet; altitude of the antimony prospect 7 miles to the southwest is about 2,500 feet. Some of the mountain tops forming the heads of valleys in the vicinity of the property attain an altitude of 3,700 feet.

Present flowsheet - Stampede mine
(Approximate capacity 30 tons per 24 hours)

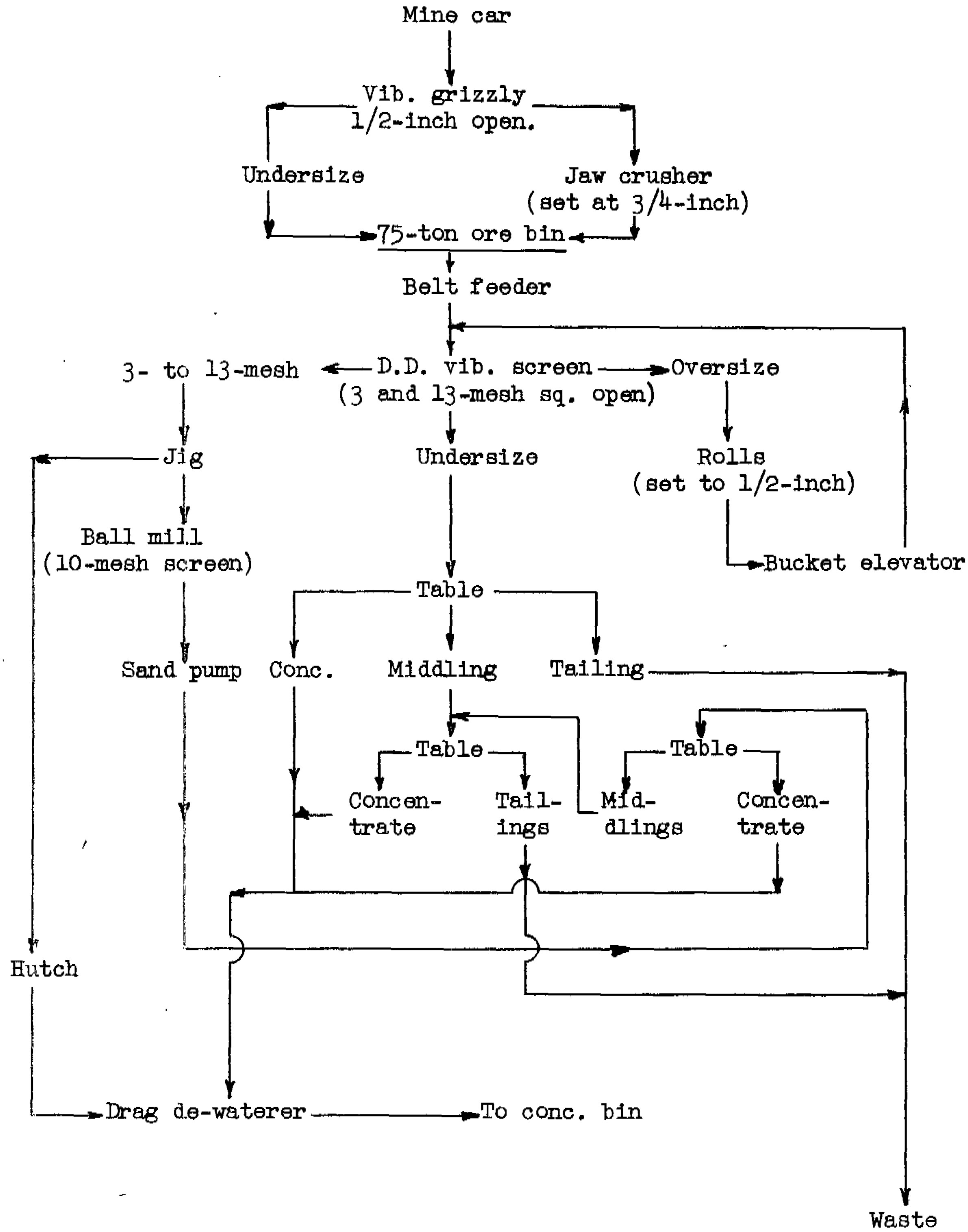

Figure 11-A.

Suggested revised flowsheet - Stampede mine

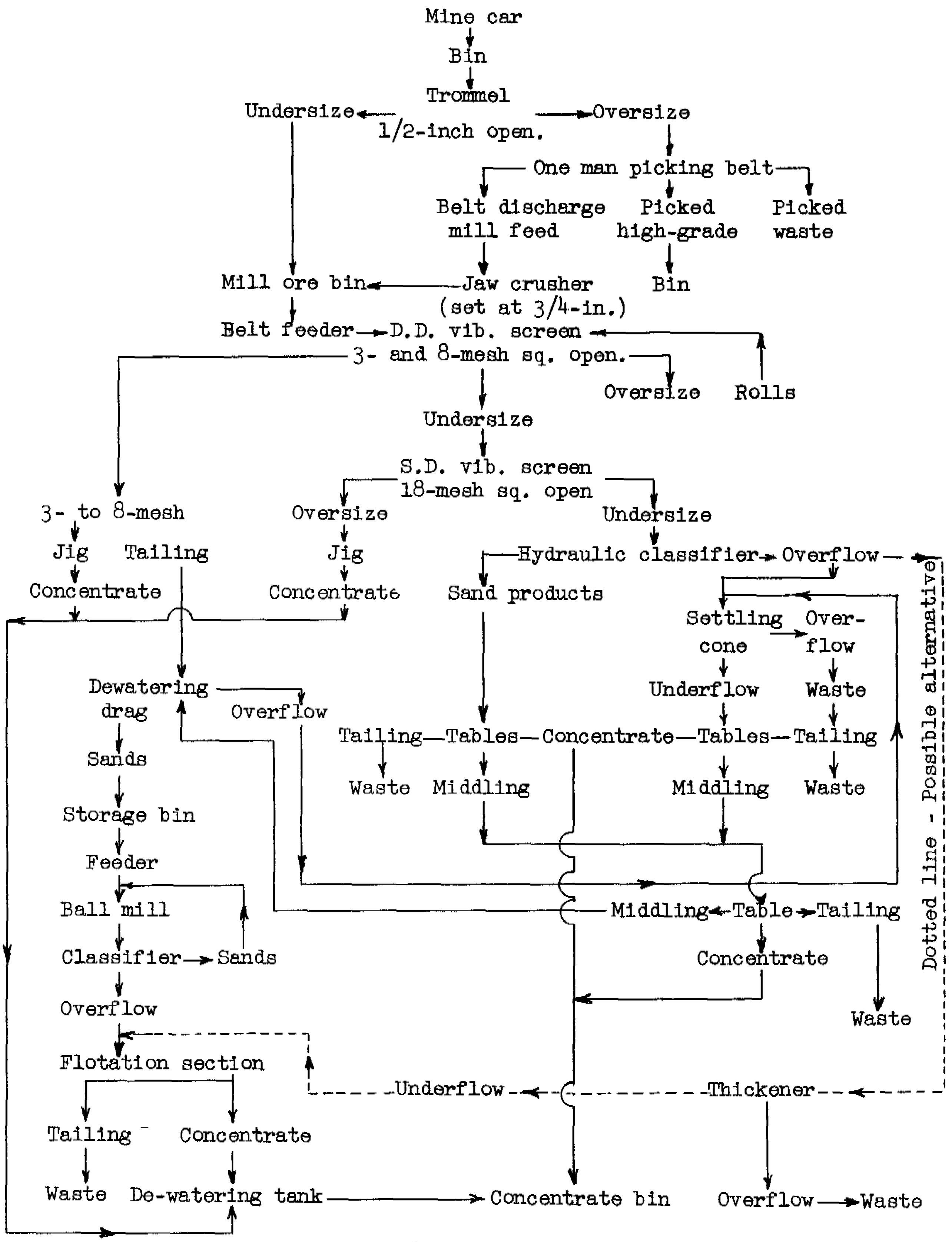

Figure 11-B.

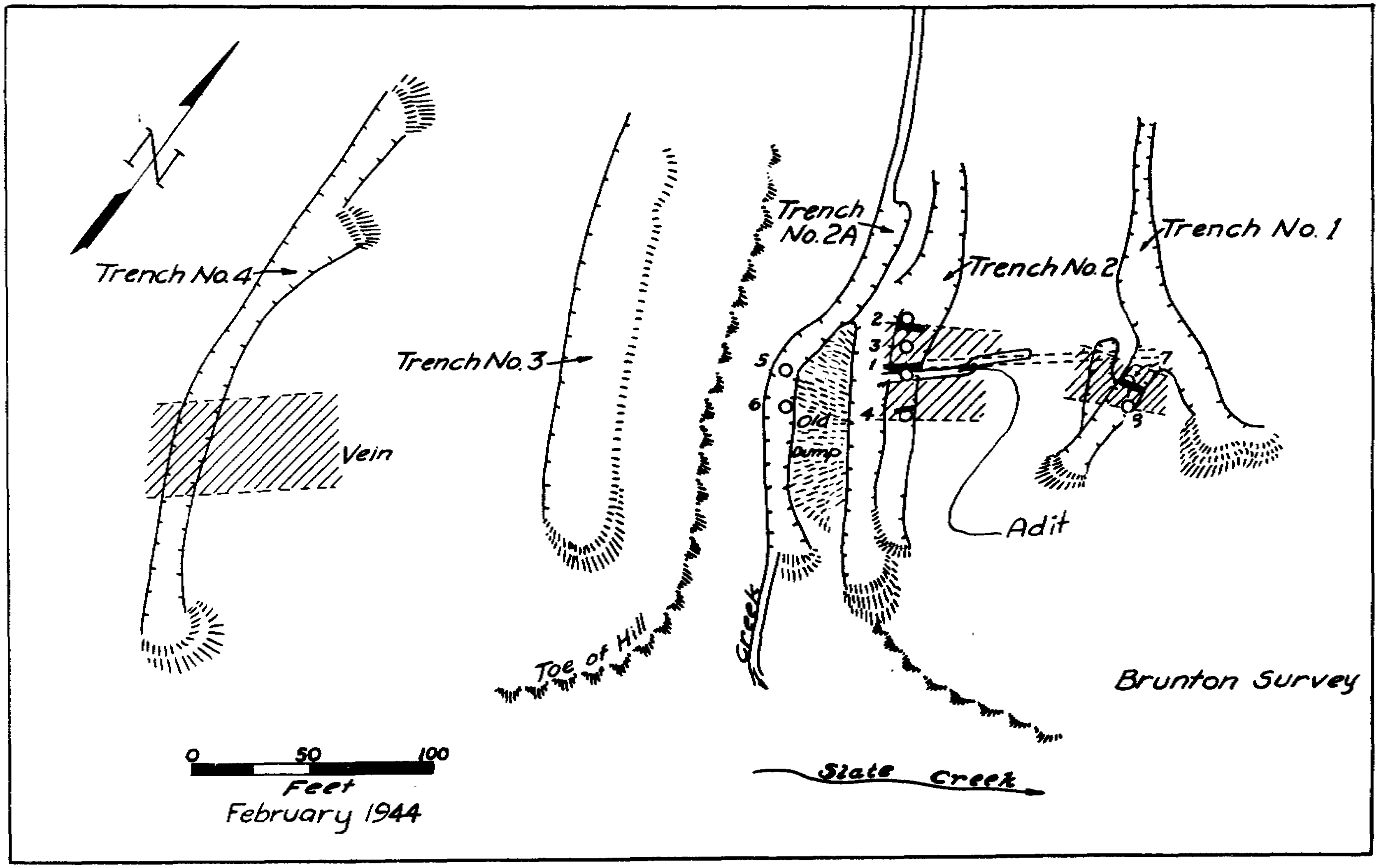

Figure 12. - Map showing trenches and churn drill holes.

The area is largely covered by a blanket of tundra and light brush. No usable timber is available in the immediate vicinity.

The climate is typical of the Mount McKinley region. (Refer to page 7.)

History, Ownership, and Production

The Slate Creek antimony prospect has been known for many years. It was first located about 1904-05. Since then the property has been re-staked numerous times. In 1915 and 1916, according to reports, a 97-foot tunnel was driven from near the creek level on the strike of a wide shear zone that enclosed the principal zones of mineralization. The tunnel location is shown on figure 12. A few short crosscuts totaling only 22 feet were driven normal to the direction of the main zone.

A small stope near the portal was begun, which later developed into a narrow open cut. Old records indicate that about 125 tons of hand-sorted ore was mined, mostly from near the portal. During the winter of 1941-42, Earl R. Pilgrim, operator and principal owner of the Stampede antimony mine, with his associates hauled out approximately 37 tons of previously sorted high-grade ore by tractor and sleds 80 miles to the Alaska Railroad and shipped it to the United States by rail and boat. This ore, according to Pilgrim, contained 58 percent antimony.

The last claim location was made in August 1942, by Ernest Maurer of Fairbanks, Alaska, who is the present owner. Two lode claims were recorded. They are located end to end, the center of the common end line being at or near the location of the old tunnel portal.

Ernest Maurer drove a 63-foot drift on one of the stronger high-grade veins and exposed the deposit at a level 16 feet lower than the old tunnel. The drift and a small stope under the portal of the old tunnel have yielded about 75 tons of picked high-grade ore containing 47 percent stibnite. The owner reported a 1943 mine production of 90 tons containing 47 percent antimony and a 1944 production of 73 tons of 48-percent ore.

Ore Deposits

The Kantishna Hills are made up of rocks which in general are either a micaceous or a quartzitic schist having a high percentage of chloritic members, limestone, and phyllite. These rocks are termed Birch Creek schist, a local name generally given to the schistose sedimentaries in and around the Fairbanks area. These rocks cover an area extending over several hundred miles and include many metamorphosed igneous rocks.

The stibnite deposits as well as the gold lodes of the district almost invariably occur in areas where the quartzitic members are a major part of the rock formation. This is true, also, in the vicinity of the Slate Creek deposit. In this particular case the schist has been intruded by a light-colored igneous rock, which appears as a large outcropping about 2 miles due east of the prospect. This rock might be classed megascopically as a syenite. However, it contains a considerable percentage of biotite and hornblende, enough possibly to be petrographically determined as diorite.

The Slate Creek antimony deposit lies within a shear zone 40 feet wide, both walls of which are a banded and schistose fresh-appearing rock. The shear zone is clearly defined. The ore zones within it are made up of oxidized and decomposed schist and stibnite or the sulf-oxides of antimony. The most pronounced line of demarcation between the shear zone and the enclosing quartzite schist is seen on the southeast or hanging-wall side. Here a strong fissure, striking N. 50° E. and dipping steeply to the southeast, forms a definite break with the country rock.

The ore body proper, as indicated on figure 13, has a maximum width of 26 to 28 feet where exposed by trench 2. The minable part of the vein consists of a reticulated stockwork of quartz, high-grade ribs of stibnite, zones of stibnite boulders enclosed by decomposed schist, and horses of almost barren decomposed schist, all thoroughly intermixed. Although, generally speaking, the ribs of high-grade stibnite parallel the strike of the main shear zone, in some cases it appeared that these ribs were of low dip and divergent from the strike of the main fissure.

Although mineralization was not found to be present in trench 4, the shear zone remained 40 feet wide with well-defined walls. Thus, the ore zone undoubtedly has been delimited to the southwest.

Character of the Ore

The principal antimony mineral present in the Slate Creek deposit is stibnite (Sb_2S_3, antimony tri-sulfide). A few ribs of almost pure stibnite, some as much as 3 feet thick, have been exposed in trench 2. These ribs of stibnite contain enough included quartz to lower the antimony content to about 60 percent.

From examination of several hundred pounds of the high-grade ore, it is found that, generally, the quartz particles are not only on the outside but also within what appears to be pure stibnite. The quartz, which is apparently the principal gangue constituent, is generally present as fine vitreous grains, whereas in a few instances it was noted as minute, amorphous, milky nodules. The stibnite exists largely as aggregates of acicular crystals, very little fine-grained stibnite being present. In some ore specimens examined it was noticed that a direct replacement of the schist had taken place and that in many instances the stibnite was pseudomorphic after the schistose structure of the country rock.

Red antimony sulf-oxide, kermesite (Sb_2S_2O), is present in many of the boulders of high-grade ore removed from the oxidized zone, whereas an abundance of the yellow oxide, stibiconite ($Sb_2O_3.Sb_2O_5.nH_2O$), or the H_2O-radical-free cervantite, or a combination of the two, is present throughout the entire mineralized zone exposed by trench 2.

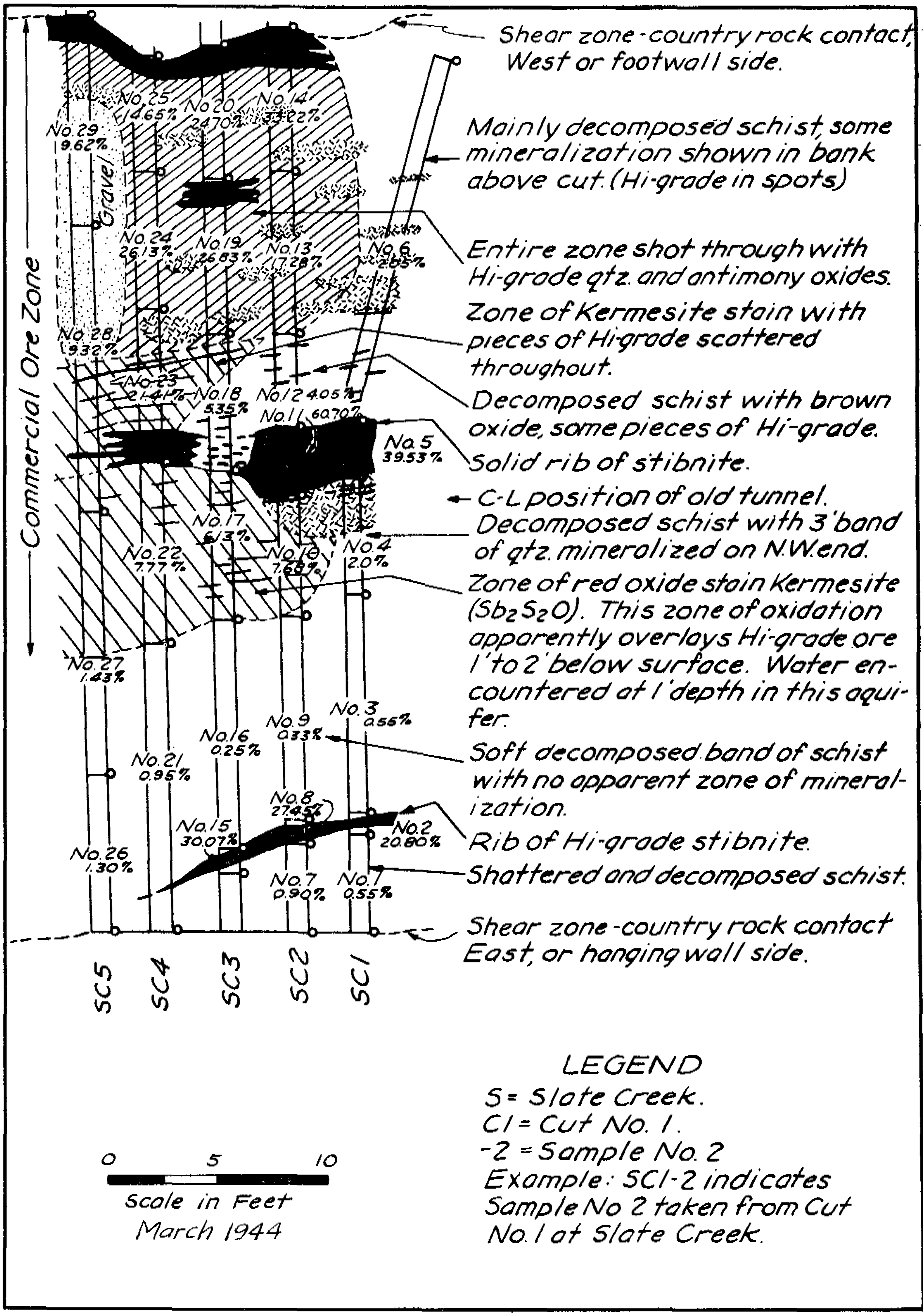

Figure 13. - Trench No. 2, showing sample cuts.

Chemical analysis indicates that no detrimental components are present in sufficient quantities to affect the value of the ore.

Work Accomplished by the Bureau of Mines

The property was first visited by a Bureau engineer on July 20, 1942. It was decided that a small amount of exploratory work was justified, both because of the past production of high-grade antimony ore based on meager development and because of its favorable geographical position only 7 miles from a highway. From August 8 to 16 five surface trenches were excavated with a bulldozer, exposing the shear zone for 400 feet. Commercial ore was uncovered and sampled in trenches 1 and 2, approximately 100 feet apart. The ore body in trench 2 proved to be 26 feet wide and was estimated to contain 18.7 percent antimony.

Churn-drilling operations were begun in late September and continued, as steadily as the isolated conditions allowed, until the middle of November. Because of low temperatures, which ranged from -15° to -55° F. during the last month of work, operations were necessarily terminated.

Surface Trenching

Five surface trenches were excavated, two of which disclosed ore of commercial value. The location of the trenches with respect to the old workings and the vein is shown in figure 12. A description of the trenches follows:

Trench 1

This trench cut into bedrock for 100 feet across the entire width of the shear zone. No vein structure was exposed. Most of the bedrock consisted of decomposed schist. This main trench followed the contour of the hillside and necessarily paralleled, in part, the strike of the vein.

A side cut from this main trench exposed a vein structure 21 feet wide containing, on the north end, one narrow high-grade rib of stibnite about 1.8 feet wide. In the main trench the high-grade stringer narrows progressively to the east and disappears under the decomposed schist.

Trench 2

This trench was excavated at the portal of the old tunnel and exposed a shear zone 42 feet wide containing a commercially minable ore zone 26.7 feet wide with an average content of 18.7 percent antimony. This trench is completely illustrated and described in figure 13.

Trench 2A

This trench was in the bottom of the creek. Bedrock was exposed for about 25 feet at the upper end, but this zone was apparently too far north to be on the strike of the vein structure. Considerable work would have been required to reach bedrock farther south, as it apparently sloped to the south at a point approximately in line with the strike of the vein structure.

Trench 3

Soft boggy ground was encountered, and eventually the trench had to be abandoned for fear of losing the bulldozer. Much water was present, apparently coming from springs having their sources in the hillside.

Trench 4

This trench is approximately 250 feet long and has exposed bedrock for almost the entire distance. The shear zone, exposed for a width of 40 feet, is made up of decomposed schist with a few scattered quartz seams. Megascopic examination disclosed no apparent mineralization. Two large samples were cut across the entire vein exposure for analysis. The zone is stained red, brown, and blue by oxidation of the schist and possibly from minute particles of stibnite.

A summary of yardage moved in trenching operations is as follows:

Trench	Length, feet	Average width, feet	Average depth, feet	Cubic yards
1	192	20	3	426
2	180	12	3.5	280
2A	150	12	4.0	267
3	160	25	2.8	415
4	270	12	5.3	636
				2,024

Trench Sampling and Analysis

As only trenches 1 and 2 exposed any apparent ore mineralization, most of the sampling was confined to these two excavations. Thirty-five samples aggregating 550 pounds in weight were cut from the five trenches.

Because of the broken condition of the wide ore zone in trench 2, it was deemed advisable to make five sample cuts across the entire zone, sampling high-grade, low-grade, and apparently barren zones separately in each cut, weighting percent by length of sample, and obtaining an average for the entire trench. Five parallel cuts 1 foot wide and 40 feet long were made across the entire shear zone. Cuts SC1 and SC5, the two outside cuts shown on figure 13, were in each case close to the bank and, because of a certain amount of bank sloughing and unremoved gravel, could not be used in calculating average values. The three inside cuts, SC2, SC3, and SC4, however, are more typical of the entire exposure and should give an accurate picture of the ore.

Table 1 gives the location and analysis of the samples obtained from the trenches.

TABLE 1. - Analysis of samples

Trench 1

Sample	Material sampled	Sample length, feet	Percent antimony	Feet times percent
SC6-30	Decomposed schist-quartz	7.7	1.15	
SC6-31	Decomposed schist-quartz	3.5	3.60	12.60
SC6-32	High grade stringer	1.8	53.80	96.84
SC6-33	Decomposed quartz-schist	8.0	1.12	
	Total	5.3		109.44
	Average		20.65	

Trench 2, Cut 1

Sample	Material sampled	Sample length, feet	Percent antimony	Feet times percent
SC1-1	Decomposed schist	4.3	0.55	
SC1-2	High grade stibnite rib	1.0	20.80	
SC1-3	Decomposed schist	9.7	0.55	
SC1-4	Decomposed schist and quartz	5.5	2.00	11.00
SC1-5	High grade stibnite rib	2.3	39.53	90.92
SC1-6	Decomposed quartz-schist	16.7	2.05	34.24
	Total	24.5		136.16
	Average		5.56	

Trench 2, Cut 2

Sample	Material sampled	Sample length, feet	Percent antimony	Feet times percent
SC2-7	Decomposed schist	4.0	0.9	
SC2-8	High grade stibnite rib	1.0	27.45	
SC2-9	Decomposed schist	9.0	0.33	
SC2-10	Decomposed schist and quartz	5.5	7.68	42.24
SC2-11	High grade stibnite rib	3.0	60.70	182.10
SC2-12	Decomposed quartz-schist	4.0	9.05	36.20
SC2-13	Stibnite ribs-schist	8.5	17.28	146.88
SC2-14	Stibnite ribs-schist	7.0	33.22	232.54
	Total	28.0		639.96
	Average		22.86	

Trench 2, Cut 3

Sample	Material sampled	Sample length, feet	Percent antimony	Feet times percent
SC3-15	High grade stibnite rib	1.0	30.07	
SC3-16	Decomposed schist	10.5	0.25	
SC3-17	Decomposed schist and stibnite	7.0	6.13	42.91
SC3-18	Decomposed schist and stibnite	6.0	5.35	32.10
SC3-19	Stibnite ribs-schist	7.0	26.83	187.81
SC3-20	Stibnite ribs-schist	6.0	24.70	148.20
	Total	26.0		411.02
	Average		15.81	

TABLE 1. - Analysis of samples (Cont'd.)

Trench 2, Cut 4

Sample	Material sampled	Sample length, feet	Percent antimony	Feet times percent
SC4-21	Decomposed schist	13.0	0.95	
SC4-22	Decomposed schist	8.0	7.77	62.16
SC4-23	Stibnite ribs-schist	7.0	21.41	149.87
SC4-24	Stibnite ribs-schist	6.0	26.13	156.78
SC4-25	Stibnite ribs-schist	5.0	14.65	73.25
	Total	26.0		442.06
	Average		17.00	

Trench 2, Cut 5

Sample	Material sampled	Sample length, feet	Percent antimony	Feet times percent
SC5-26	Decomposed schist	7.0	1.30	
SC5-27	Decomposed schist and quartz	12.0	1.43	
SC5-28	Decomposed schist and gravel	13.0	9.32	121.16
SC5-29	Decomposed schist and gravel	10.0	9.62	96.20
	Total	23.0		217.36
	Average		9.45	

Trench 2A and 3

No samples were taken as bedrock could not be reached.

Trench 4

Sample	Material sampled	Sample length, feet	Percent antimony	Feet times percent
SC7-34	Decomposed schist	40.0	0.53	
SC7-35	Decomposed schist	40.0	0.90	
	Total (not used)			
	Avorate (not used)			

The evaluation for trench 2 is a weighted average of the three middle cuts as follows:

Average value of trench 2

Cut	Total width, feet	Percent antimony	Width times percent
SC2	28.0	22.86	639.96
SC3	26.0	15.81	411.02
SC4	26.0	17.00	442.06
Total	80.0		1,493.04
Average	26.67	18.66	

Churn Drilling

The drilling operation was designed to give information on the dip and possible rake of the ore body, the value of the ore body at depth, the advisability of still further exploration, and the ore reserves to be expected. In addition, the information obtained would provide a basis for choosing between a "high-grade" mining operation and a milling operation.

The location of the eight churn holes is shown on figure 12. Sample analyses are as follows:

Sample interval, feet	Percent antimony							
	1	2	3	4	5	6	7	8
0-5	4.34	Nil	7.70	1.35	0.50	0.25	12.23	Nil
5-10	6.34	Tr.	0.54	1.35	Tr.	0.20	1.50	Tr.
10-15	9.30	Nil	Nil	1.24	Nil	Tr.	1.08	0.85
15-20	7.30	Nil	Tr.	0.50	Nil	Nil	1.05	0.94
20-25	27.51	Nil	Nil	Nil	Tr.	Nil	0.89	1.45
25-30	5.29	0.50	Nil	Nil	Nil	Nil	0.50	0.50
30-35	3.07			Tr.	Nil	Nil	0.50	Tr.
35-40	6.19			Nil	Nil	Nil	0.50	Tr.
40-45	2.54			Nil			Nil	Nil
45-50	2.22			0.50			Nil	Nil
50-55	0.74							
55-60	Nil							
60-65	0.74							
65-70	0.03							
70-75	Tr.							
75-80	Nil							
80-85	Nil							
85-90	Nil							
90-95	Nil							
95-100	Nil							

Five-foot intervals were drilled, and all cuttings obtained were saved, dried, thoroughly mixed, and quartered. Pannings were made and records kept every time the mud pump was used, which usually was five to eight times in each 5-foot drilling interval. Double 20-pound samples were saved from the cuttings from each 5-foot section of the hole.

It was assumed from a study of the high-grade lenses and ribs exposed in trench 2 that though, in general, they paralleled the strike of the main shear zone, many of the ribs had low-angle dips. The results of the churn drilling did not substantiate this theory but indicated the ribs were almost vertical. A hold collared on a high-grade rib soon inclined towards the softer decomposed schist and had a tendency to remain in the softer material. For this reason churn-drilling results are not entirely satisfactory, as they might not give an accurate impression of the deposit at depth. The results obtained preclude further exploratory work by vertical-hole methods.

Recent Operations

During the summer and fall of 1943 the bottom of trench 2 was lowered 11 feet. The ore body penetrated was similar to that found above. From this trench a 63-foot drift was driven easterly on the strongest high-grade rib. The drift was 16 feet below the old tunnel and almost directly under it. This high-grade rib, indicated by sample 11 (fig. 13), ranged from 1 to 3 feet wide and was 22 inches wide at the bottom of the face 63 feet from the portal. A narrow stope 14 feet long was started at a point 19 feet from the portal and extended to the old tunnel above.

The new work substantiates the churn drilling results relative to the steep dip of the high-grade ribs.

MY CREEK PROSPECT

Location and Accessibility

An antimony prospect is in a broad saddle in the ridge south of My Creek, about 140 miles east of Fairbanks, Alaska, at latitude 64° 14' north and longitude 143° 18' west. My Creek is a westward-flowing tributary of Molly Creek, which is the easternmost of two large streams constituting the headwaters of the Middle Fork of Fortymile River. Fortymile River flows into the Yukon Territory to join the Yukon River 60 miles upstream from Alaskan soil.

Several base-metal deposits are rumored to exist in this isolated locality, but costly transportation discourages prospecting and development. With the exception of an inadequate 800-foot landing field usable only in the summer and a temporary snow field prepared during the described exploration, the nearest usable landing field is at Chicken, an air distance of 50 miles and a trail distance of 80 miles away. Fairbanks to Chicken air-freight rate is 10 cents a pound, and the passenger fare on scheduled trips is $30 plus tax. Tractor freighting over the 80 miles from My Creek to Tanacross on the Alaska Highway would cost at least $20 a ton. A road is now (1947) being build from the Alaska Highway to Chicken and will provide easier access to this area.

The high-grade float that led to the discovery of the property was found in a boggy depression on a broad ridge at an altitude of 3,800 feet.

There is some scattered timber in the vicinity.

The nearest weather station is at Eagle, Alaska, 70 miles northwest of the prospect. Average annual rainfall there is 11 inches, snowfall is 53 inches, and the annual mean temperature is 25° F.

Ownership

The original discovery of the property was made by Ted Machette in 1918. Paul Glasgow later staked the deposit and still claims that the assessment work has been done. The lode claims, Grey Wolf 1 and Grey Wolf 2, are held jointly by Anne and Fred Purdy, Lisetta and Dan Manske, and Ethyle and William Taft, who most recently located the property. The last-named locators conducted and financed the churn-drill exploration.

Ore Deposits

The country rock in this vicinity consists principally of a brown, medium-hard, quartzitic schist that sometimes grades into a quartz-mica schist.

The high-grade stibnite float is highly lustrous and coarsely crystalline. About 4 tons of this high-grade ore, estimated to contain 50 percent antimony, has been collected from the pits and open cuts during prospecting. One large piece of float was over 1.5 feet wide and 3 feet long. Several tons of lower-grade float have been collected. The low-grade float consists of stibnite in a vuggy quartz gangue.

The exploration contributed little additional information on the nature of the deposit. The area containing the most intense distribution of stibnite float is about 400 feet long and 100 feet wide and is covered with 4 to 10 feet of moss-carpeted muck ("muck" in Alaska refers to a very fine silt) and slide rock. Float gradually diminishes to the northwest at right angles to the long axis of the area. Drilling was done along the southeast border of the float-bearing area.

Drill holes 1, 2, 3, 8, and 9 were grouped in a circular area about 80 feet in diameter. A study of the altitude, location, and logs of these holes indicates that the strata are dipping 20 degrees southeast. Stibnite float is found in the middle of this area and continues in diminishing amounts northwest. The distribution of float further substantiates the probable orientation of the mineralization by indicating the former position of the vein. Hole 7, started at a higher elevation than the holes mentioned above, probably did not go deep enough to penetrate the same zone of mineralization cut by them. Holes 4, 5, and 6 are east of and stratigraphically above the mineralized zone.

Except for the hard, brown, quartzitic schist penetrated below the mineralized zone, the rocks cut were either vein quartz or a highly altered claylike material. Some of the cuttings could be identified as altered mica schist, and limestone was identified in the ore horizon.

A 5-inch churn drill was used in the exploration. Each pumping was panned for stibnite, and a log was kept of the drilling. Hole 3 was drilled before the arrival of the Bureau of Mines sampler,7/ and in this case the ore

7/ S. L. Cotton, sample foreman.

drilled had been panned and the gangue was discarded, making it impossible to obtain an accurate sample. It was estimated from the volume and grade of material saved that a 2-1/2-foot section of ore drilled contained slightly over 5 percent antimony.

Four 5-foot sections sampled in hole 7 were too low in antimony content to merit individual analysis, and a composite sample contained only 0.19 percent antimony. No stibnite was encountered in the other six holes.

The nine holes ranging in depth from 10 to 49 feet aggregated 248 feet of drilling.

Development

The results of the recent churn-drill exploration are important in planning any future exploration. Test pits and open cuts excavated earlier have caved, and there is no record of what was found. There are no underground workings on the property.

TOK RIVER PROSPECT

Location and Accessibility

The antimony deposit of the Tok River region is at approximate longitude 143° 48' W. and latitude 63° 15' N. in the northern part of the Chitina recording district, west central Alaska, on Boulder Creek, a northern headwater tributary of the Tok River, as shown on figure 14. This deposit is about 17 airline miles southwest of Tanacross and approximately 250 miles by highway from tidewater at Valdez.

The property may be approached to within 22 miles by automobile by way of the Richardson Highway and Slana Cut-off. The remaining distance can readily be traversed on foot by leaving the Slana Cut-off at the confluence of the Little Tok and Tok Rivers and proceeding up the Tok River to Boulder Creek.

A natural airplane landing strip about 1,800 feet long at the mouth of Boulder Creek on the valley floor of the Tok is suitable in winter for ski-equipped aircraft. This strip could be made safe for summer use by cutting some small patches of brush and making a few small fills.

Physical Features and Climate

The maximum local relief of the Boulder Creek area is approximately 4,000 feet. This area is characterized by high, steep, irregular mountains, which rise abruptly above the valley floor of the Tok. The lower portions of these mountains, near the base, are covered with a thick mantle of moss and sporadic growths of scrub spruce, alder, and some birch.

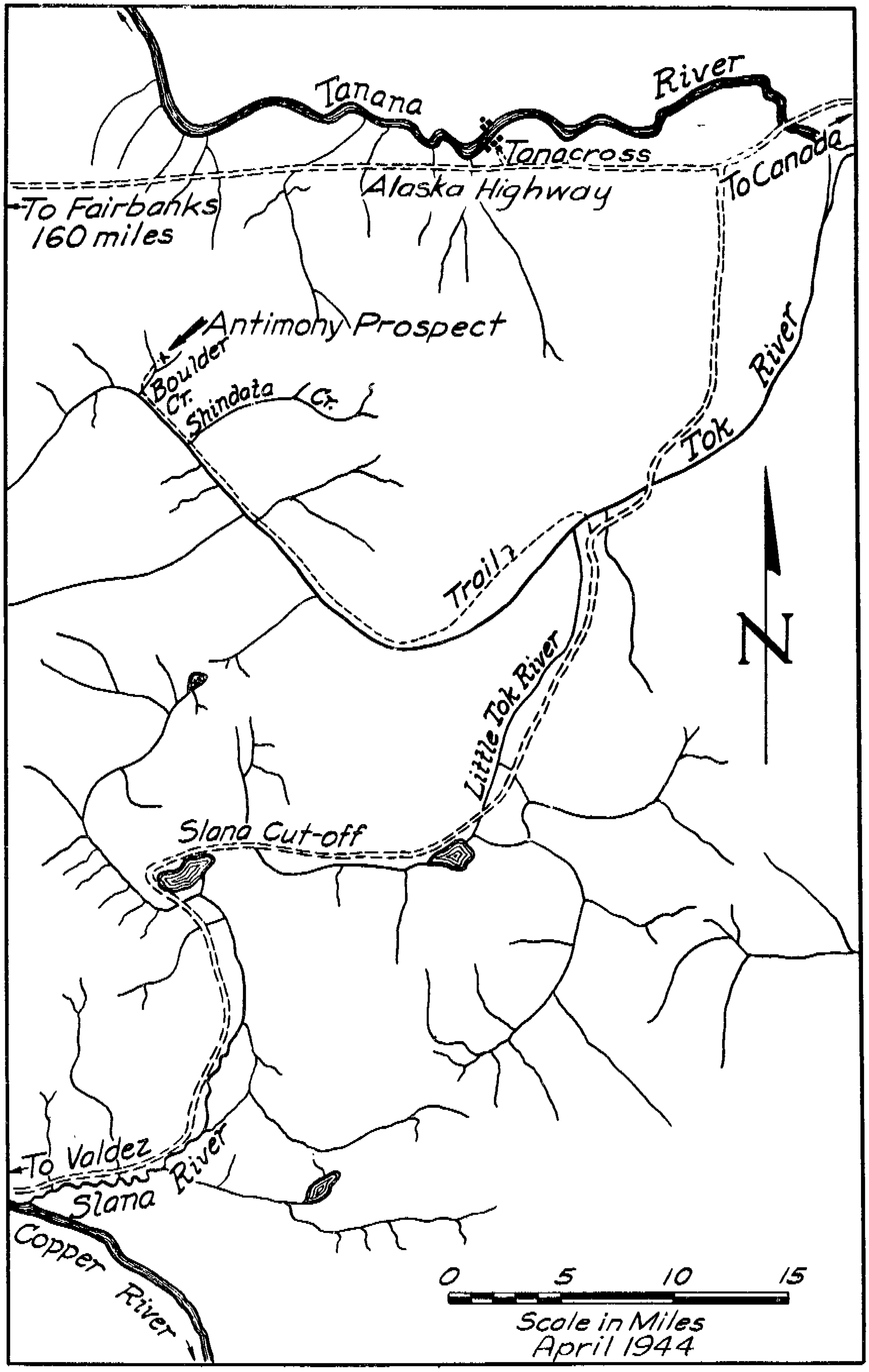

Figure 14. - Slana-Tok district.

The Tok River is a glacial stream that is constantly changing its course across its wide valley floor. There is evidence along the upper reaches of the River showing where it has at times covered the entire valley during a flood stage. Boulder Creek is not a glacial stream; its waters are derived from seasonal rains and melting snow from the high surrounding mountains. Although it flows in a V-shaped valley, there is evidence of recent glaciation. In summer Boulder Creek contains enough water for mining, milling, and other needs, but during the coldest winter months it is doubtful whether there would be enough for all purposes.

The spruce trees that grow near the deposit are scattered and scrubby, and very few would be useful for mine timbers. However, 1-1/2 miles downstream, at the mouth of Boulder Creek, is a considerable quantity of spruce that would be suitable for mine timber and saw logs. At this place, many trees measure 18 and 24 inches in diameter. At another location, about 2 miles down the Tok from the mouth of Boulder Creek, is a much larger stand of spruce timber suitable for mining purposes.

The climatic conditions of the area are characterized by long, cold winters with subzero temperature and fairly heavy snowfalls accompanied by strong winds. Summers in this high, mountainous area are moderately warm and rains fall frequently.

History and Production

It has been reported that this antimony deposit was discovered about 40 years ago by a man named Frank Caulk. Caulk drove a small adit about 12 feet long diagonally across the lode and then abandoned it. It was not until the summer of 1940 that any consideration was given the deposit. At this time, Sam Gamblin staked the lode and did a small amount of exploring. During exploration Gamblin and his assistants hand-sorted and stock-piled several tons of material with the purpose of shipping the higher-grade material. Unfortunately, the stock piles were washed away by the flood waters of Boulder Creek, and he was unable to make any shipments. When the property was visited about 18 months later, much of this material could be seen scattered along the creek banks several hundred feet below the workings.

Up to the present time no further work has been done, except sampling by various engineers.

Property and Ownership

The mining rights of the claims covering this property are held by Sam Gamblin of Fairbanks, Alaska. A group of four claims, approximately 600 feet by 1,500 feet, were recorded in the recording office at Chitina, Alaska, and are as follows:

Name of claim	Date staked	Date recorded
Rambler No. 1	6-10-40	9-24-40
Rambler No. 2	6-10-40	9-24-40
Rambler No. 3	9-9-42	Not known
Rambler No. 4	9-9-42	Not known

General Geology[8]

The prospect in the Tok Valley is on a tributary of the river flowing in from the north and joining it 7 miles above the mouth of the Dry Tok, or 2-1/2 miles above Shindata Creek. This tributary stream has two branches, which come together about 1 mile above its mouth. On the south side of the eastern branch, nearly half a mile from the forks, an old prospect hole was driven in a mass of stibnite cropping out in the canyon wall at the edge of the gravel bar.

The country rock is chiefly metamorphosed sedimentary deposits, which are nearly everywhere siliceous and have been folded, faulted, and cut by granular intrusive rocks now considerably altered. Near the forks of the creek soft gray or black schist that plainly lies in a zone of faulting forms a high wall on the south. It dips southwest and is underlain by the siliceous schistose beds, which show some differences in appearance from place to place and extend up the creek beyond the tunnel. The siliceous schist appears to be a succession of altered quartzite beds but presents phases that possibly indicate altered siliceous intrusive rock. Exposed surfaces of the schist commonly show a fine banding caused by alternating thin layers or lenses and sheets of granular quartz and brownish mica. The appearance of a clean surface is striking and at a short distance suggests a sheaf of white or gray paper ruled with straight, closely spaced, parallel lines. At the tunnel the banded schist is interrupted by a finer-grained siliceous rock with rusty weathering on exposed surfaces and joint faces, which appears to be a silicified sedimentary bed but possibly is an altered fine-grained intrusive. It is 100 feet thick, strikes N. 67° to 73° W., and dips about 50° S. Like the other rocks of the vicinity, it is much faulted and is filled with veins of glassy bluish-gray and white quartz.

The ore body forms the base of a projecting ledge or spur of the silicified rock about midway between the two schist boundary lines and lies mostly in a single bed or block about 8 feet thick, which is more massive than the adjacent rock and makes the nose of the spur. Stibnite that occurs chiefly as a granular mass but in part in coarse shining crystals replaces the siliceous rock completely in the lower part of the deposit. Elsewhere it partly replaces the country rock, is disseminated through it, or cuts it in well-defined veins. This mineralized block shows a triangular face about 25 feet high and 20 feet across the base at the gravel bar.

The floor of the short tunnel is 5 feet above the gravel bar and follows a small vein of stibnite in or near a fault in loose caving ground. It shows much less of the ore body than is exposed on the surface below and west of it, and this fact and the general appearance of the mineralized part of the spur suggests that the continuation of the mineralized body may be below the level of the bars rather than up the canyon wall.

8/ Moffit, Fred H., Geology of the Slana-Tok District, Alaska: Geol. Surv. Bull. 904, 1938, pp. 43-44.

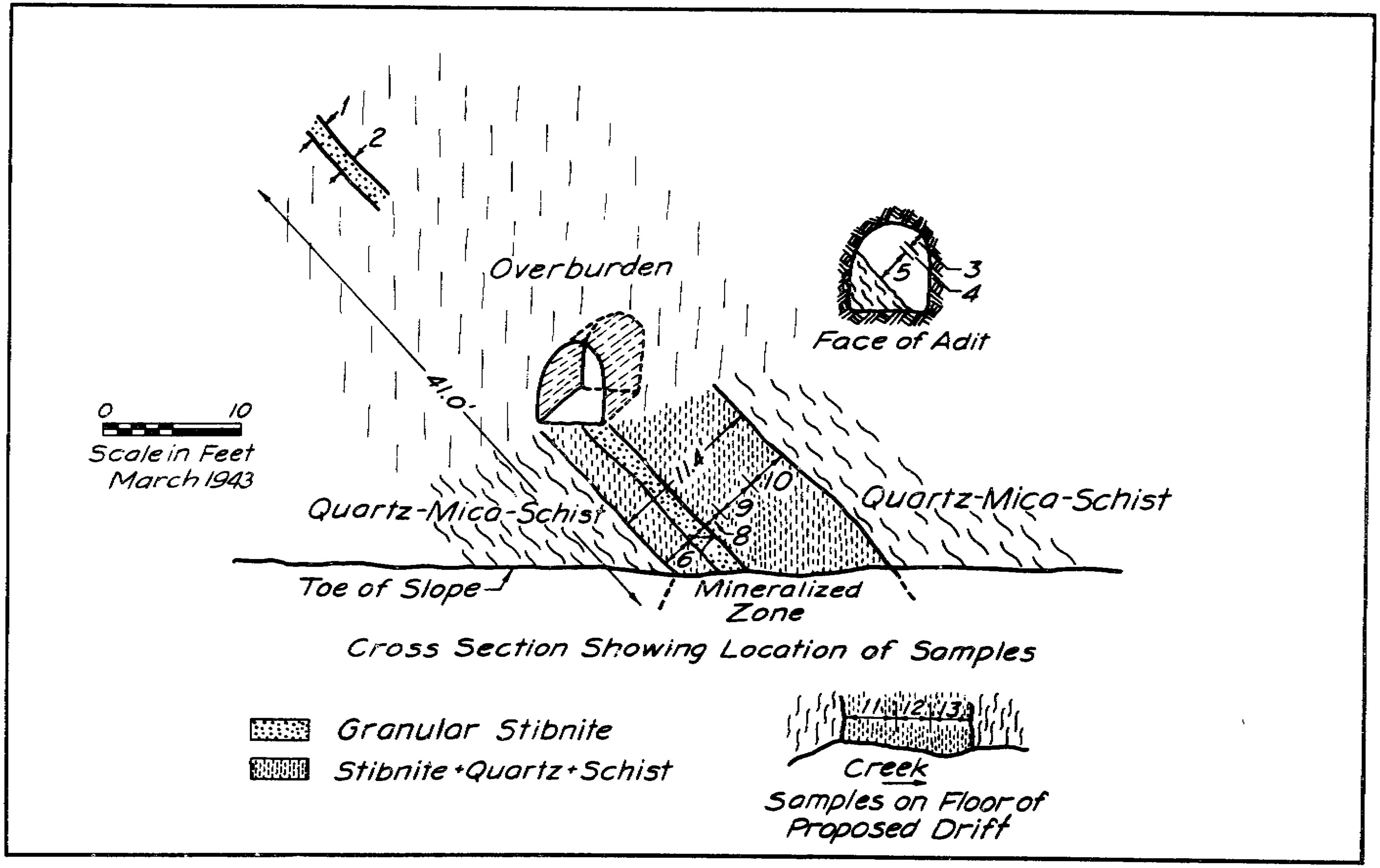

Figure 15. - Sketch showing location of samples.

The original owner of the property has done nothing on it for many years and was not available for consultation regarding his findings, but recent assays show that the ore contains a little gold.

Occurrence of Deposit

The antimony deposit outcrops near the water's edge at the toe of a high bench on the east wall of Boulder Creek. The valley floor is approximately 150 feet wide at this point, and the steep valley walls give a decided canyon effect.

The rock near and enclosing the antimony deposit is a quartz-mica schist, which has been subjected to much folding and faulting. The average of strike and dip readings taken at several places close to and adjoining the deposit shows the planes of schistosity strike about N. 10° W. and dip 49° to the southwest.

The mineralized zone bounded by two fault planes, one along the footwall and one along the hanging wall, is about 11-1/2 feet wide, strikes N. 10° W., and dips about 46° to the southwest, as shown in figure 15.

Character of Mineralization

The mineralized body contains stibnite in both the coarse crystalline and massive granular forms. The coarse crystalline stibnite is intermixed with quartz and occurs as small, irregular, lenticular masses disseminated through quartz mica schist. The massive variety, found as a vein 2 feet above the footwall is 1.5 feet wide and can be traced for 41 feet along the dip. The gangue mineral is quartz with clay and schist.

Sampling and Assaying

Fourteen samples were obtained; thirteen of these were channel samples taken from the outcrop and one, reputed to be a representative sample of the highest-grade stock pile, was given by Gamblin to the examining engineer. Two samples came from the uppermost portion of the mineralized zone and three from the floor of an excavation for a proposed adit. (See fig. 15.)

Where possible, all channel samples were 5 inches wide and 2 inches deep.

All samples were analyzed at the Territorial Assay Office, Anchorage, Alaska. The results are shown in table 2.

The granular stibnite, which occurs as a vein 2 feet above the footwall of the lode, averages 1.4 feet in width and has an average antimony content of 32.9 percent. The remaining 10 feet of the lode; coarse crystalline stibnite intermixed with quartz and occurring as irregular lenticular masses disseminated through schist, has an average antimony content of 8.7 percent.

A sample from the hand-sorted stock pile that had been washed away by flood waters shows an antimony content of 32.8 percent.

TABLE 2. - Tabulation of sampling results

Sample	Percent Sb	Percent As	Percent Cu	Width, feet, right angle to dip	Description
1	34.48	0.06	Trace	1.3	Granular stibnite from top exposure.
2	26.76	.10	Trace	1.3	3.6 feet down dip from No. 1, granular stibnite.
3	3.90	.40		1.5	From hanging wall in old adit - quartz and stibnite.
4	20.80	.2	Trace	0.45	Coarse crystalline stibnite from old adit.
5	14.92	.10		2.7	From footwall in old adit - quartz and stibnite.
6	13.62	.05		2.4	From footwall of wide mineralized zone. Quartz and coarse crystalline stibnite quartz predominant.
7	35.04	.06	Trace	1.5	From wide zone above No. 6 - solid granular stibnite.
8	20.48	.30		1.5	From wide zone above No. 7 - stibnite with some quartz.
9	Trace	.18		3.0	From wide zone above No. 8 - crushed schist, quartz, and stibnite.
10	0.87	.30		3.0	From wide zone above No. 8 - at hanging wall, quartz with stibnite.
11	19.58	.20		2.5 hor. meas.	From floor proposed drift - granular stibnite.
12	3.08	.20		2.3	From floor proposed drift- quartz, schist, stibnite.
13	9.40	.20		2.8	From floor proposed drift - quartz, stibnite.
14	32.80	Trace	Trace		Sample of stock pile high-grade, hand-sorted.

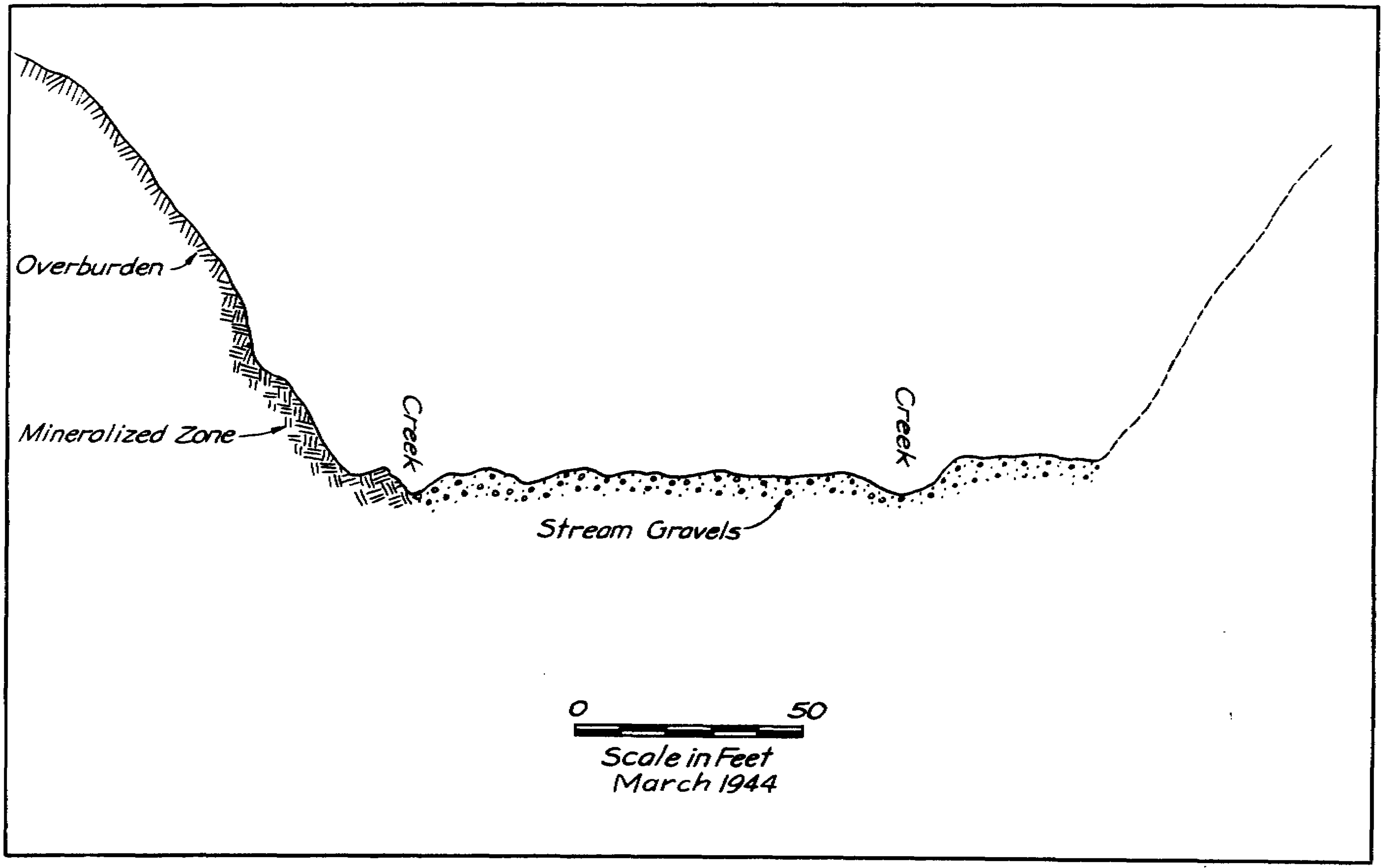

Figure 16. - Sketch showing profile of Boulder Creek at antimony deposit.

Development

During the fall and winter of 1940-41, a log cabin was constructed about half a mile below the property, and a small blacksmith shop was built just across the creek from the outcrop. At this time preliminary work preparatory to driving an adit from the creek level along the strike of the mineralized zone was started. The hand methods used were inadequate for making any amount of progress, and after a portion of the outcrop was leveled off the work was discontinued. The excavated material was hand-sorted and put in the stock piles that were washed away.

The deposit, exposed for approximately 36 feet along the strike and 41 feet along the dip, is only partly explored. (See fig. 16.)

BLACK RAPIDS

Location and Accessibility

The Black Rapids prospect is 1-1/2 miles south of the Rapids Roadhouse at mile 233 on the Richardson Highway. The prospect is 1/3 mile east of the highway and on the east side of the Delta River, directly across from Black Rapids Glacier. It has an altitude of 2,400 feet, approximately the same as the road at this point, from which the prospect is readily accessible.

Many years ago, Egan Petrokov, the present owner, explored a quartz vein and an adjacent stibnite lens on the prospect by open cuts and some stripping. An adit driven on the vein revealed it to consist mostly of quartz and pyrite.

Geology

The geology of the area is outlined by Moffit[9] as follows:

> The dominant rocks of the Gerstle River district are schist and gneiss of pre-Paleozoic or possible Paleozoic age. They are metamorphic rocks, derived partly from old sedimentary beds and partly from igneous intrusives and are conspicuously lacking in calcareous members. They are found throughout the district. The schist and gneiss are intruded by granite and related granitic rocks occurring in the form of dikes, sills, and larger masses of irregular shape. Most of these igneous rocks are not much altered, if altered at all, and therefore, unlike the schist and gneiss, show little tendency to cleave along definite planes.
>
> Subordinate in amount and much younger in age than the schist and gneiss are beds of sand, gravel, and clay, which locally contain beds of lignite. These younger beds are only partly consolidated. They lie on the eroded surface of the schist and gneiss and are restricted to a few small areas, which probably represent formations that were once more extensive

9/ Moffit, Fred H., Geology of the Gerstle River district, Alaska: U. S. Geol. Surv. Bull. 926-B, 1942, p. 118.

than at present. They are correlated with the Tertiary coal-bearing beds that crop out in much larger bodies farther west along the north frot of the Alaska Range.

Mineral Deposit

The deposit consists of at least two veins, the larger of which crops out at the edge of a small pond, where an adit had been driven more than 30 feet. In the first 30 feet the adit shows a vein 1 to 3 feet wide consisting of sheared quartz and numerous pyrite cubes. No antimony exists in this part of the vein and beyond the adit is caved. The vein is nearly vertical and strikes N. 70° E. Faulting during or since the formation of the vein is indicated by "slickensides" and brecciated quartz.

A quartz vein of similar attitude and composition is revealed by an outcrop 250 feet east of the adit portal and by stripping of the intervening area. An exposure of approximately 50 feet reveals a small amount of antimony estimated to be less than 1 percent of the vein material.

A shallow open cut about 10 feet long and 30 feet south of the stripped quartz vein reveals a lens of stibnite and quartz a few inches to 12 feet in thickness. The strike of the lens is N. 70° W. parallel to the foliation of the schist, but the dip is much steeper than the schist. The schist walls are extensively silicified and pyritized.

Stibnite is the only antimony mineral of economic interest. It occurs as coarse, bladed crystals. A specimen representative of the lens contained, according to S. H. Cress of the Geological Survey, 36.46 percent antimony but no gold or silver.

RIDGE CLAIM DEPOSIT

Location and Accessibility

This deposit is 70 miles south of Fairbanks on a spur between the headwater forks of Kansas Creek 8 miles above the confluence of Kansas Creek and Wood River. It is a mile northwest of the Kansas-Dry Creek pass on a right limit ridge. The prospect is about 100 feet above the Kansas Creek bed and 4,800 feet above sea level.

A 70-mile winter trail leads from Fairbanks across the Tanana valley to Wood River and thence to the mouth of Kansas Creek. A 50-mile tractor route from Wood River to the Richardson Highway near Birch Lake could be established. An all-year road connects Birch Lake and Fairbanks, a distance of 60 miles.

Property and Ownership

The property consists of one lode claim, called "Ridge Claim," and is held by Howard Sparks of Fairbanks.

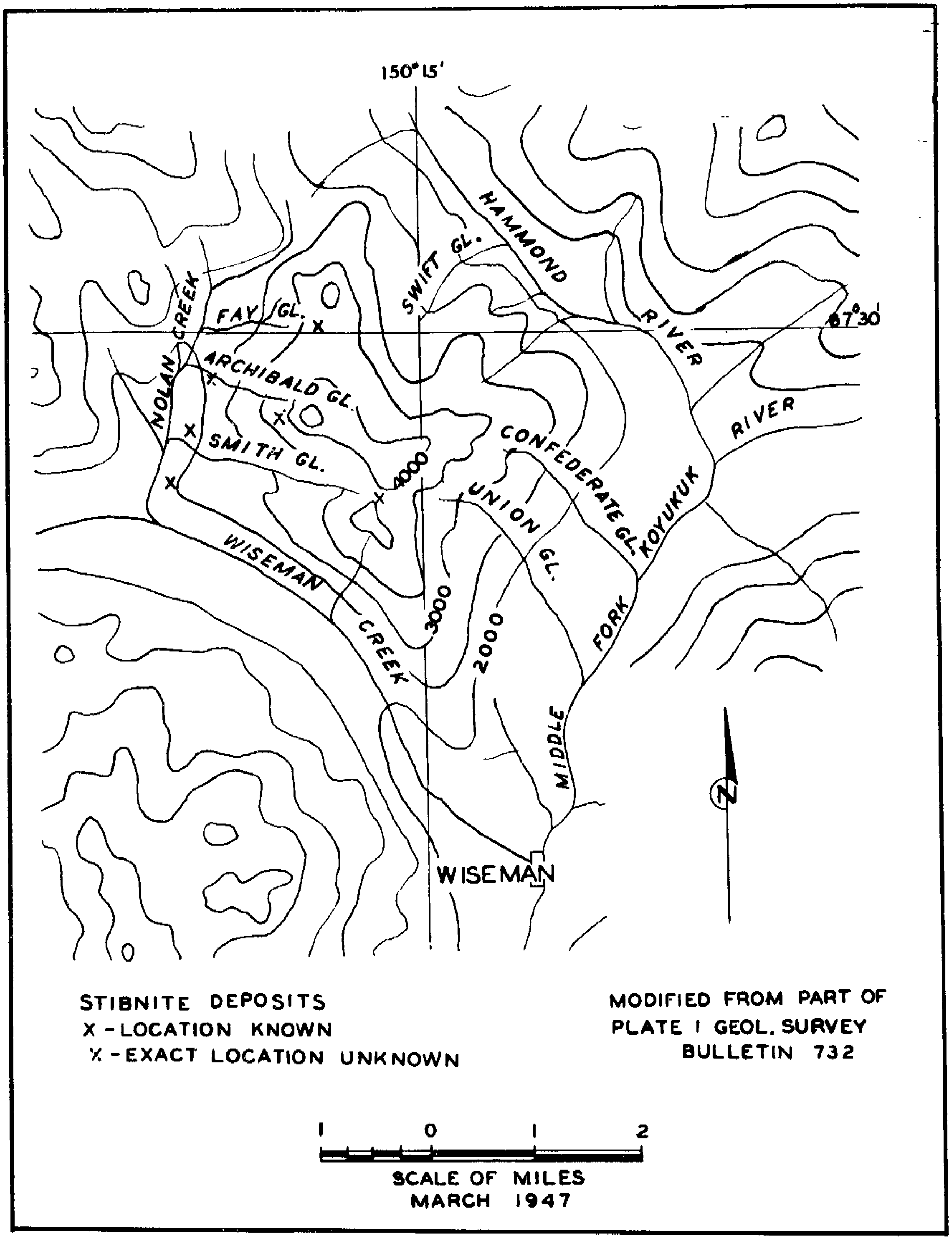

Figure 17. - Location of stibnite deposits near Wiseman, Alaska.

Geology

The country rock in the vicinity of the deposit is a black, slaty schist somewhat contorted and faulted. Rhyolite flows and granitic intrusives are contained in the schist. The strike of stibnite lode is northeast and appears to conform to that of the schist. Also parallel to the schistosity are numerous veins of barren glassy quartz a few inches to 4 feet thick.

The Deposit

The deposit has been prospected by two trenches 60 feet apart excavated 2 feet wide and 20 feet long. A zone of crushed quartz containing small lenses of stibnite was found in the upper trench. Six feet of stibnite in a zone of crushed quartz was found in the lower trench.

The trenches disclose a wide quartz zone containing lenses of stibnite a fraction of an inch to a foot across. Vein quartz and schist are contained in some of the lenses; virtually pure stibnite is found in others.

DEPOSITS NEAR WISEMAN

Stibnite-bearing veins occur 3-1/2 to 5-1/4 miles northwest of Wiseman in the hills between Wiseman Creek, its tributary Nolan Creek, and the Hammond River. Four of the deposits are along the east side of Nolan Creek Valley, and two of the deposits are on the ridge crest between Nolan Creek and the Hammond River. (See fig. 17.)

The country rock of the area is a dark micaceous schist. Stibnite veins, with or without quartz, cut across the foliation. The veins are narrow, ranging in width from 1-1/2 to 6 inches.

The Ferguson prospect is in a saddle between the heads of Smith and Union Gulches at an altitude of 3,500 feet. A pit 3 feet deep exposes a 6-inch vein that strikes north and dips 30 degrees east. Unoxidized kernels of stibnite are enclosed in an earthy matrix of yellow oxides of antimony.

The Geological Survey party of 1942 reopened a caved prospect in the saddle at the head of Fay Gulch and revealed a vein 6 inches wide striking N. 5° E., and dipping 50° east. The ore consisted of oxidized stibnite.

Jones and Boyle, individual placer-mining operators, exposed stibnite in bedrock beneath gravel on the north side of Smith Gulch near its junction with Nolan Creek. Six parallel vertical veins strike N. 40° E. A central zone of stibnite 1-1/2 to 2 inches wide is bordered on both sides by vein quartz to form a typical 3- to 4-inch wide vein. The veins are 1 to 40 feet apart, and extend the full length of the exposed bedrock. One had a visible length of 100 feet.

Placer mining in the Wannemaker and Wortman cut on the south side of Smith Gulch revealed a narrow stibnite vein. The stibnite appears to be a central filling in former open spaces between terminated crystals of quartz that were deposited before the stibnite along the fissure walls.

Underground placer mining is reported to have uncovered a stibnite deposit on Archibald Gulch some years ago. Another is said to have been found on a spur between Archibald and Smith Gulches.

FAIRBANKS DISTRICT

Antimony deposits occur within two well-defined zones of gold mineralization in the Fairbanks district. The Pedro Dome gold belt, the larger of these, begins about 10 miles north of Fairbanks and extends east-northeast for nearly 20 miles. It is 1 to 4 miles wide. The second, or Ester Dome, area is about 10 miles west of Fairbanks. One stibnite deposit outside either of these zones is in the Rose Creek Valley south of Pedro Dome. Figures 18 and 19 show the location of all the known antimony deposits of any significance in these areas.

The country rock consists of pre-Paleozoic sedimentary schists, together with smaller amounts of gneiss and limestone. Ore deposits are considered to be genetically related to several granitic intrusives of the area. Gold-bearing quartz veins 1 to 2 inches wide transect the cleavage of the schist.

Lenses of sulfide ore occur mainly along the borders and less commonly within the quartz veins, but similar bodies are also formed along fissures and in shear zones where little or no quartz is present. The ore shoots range 1 foot to 100 feet in length, a few inches to 6 feet in thickness, and up to 12 feet in width.

The antimony content of the ore ordinarily ranges from 45 to 65 percent. All the ore so far mined in this district has been found within a few hundred feet of the surface in the zone of weathering and is more or less oxidized.

The Scrafford mine, the largest producer of antimony ore in the Fairbanks district, has been the source of approximately 60 percent of past production. The stibnite claim in the Ester Dome area produced about 300 tons of ore. Several large lenses of stibnite were found at both of these properties.

The Hindenburg claim, now known as the Markovitch property, is a third source, where several lenses yielded about 200 tons of stibnite ore. Additional ore was produced from the Spaulding, Chatham, Frederick, McQueen, Gilmer, and a few other properties.

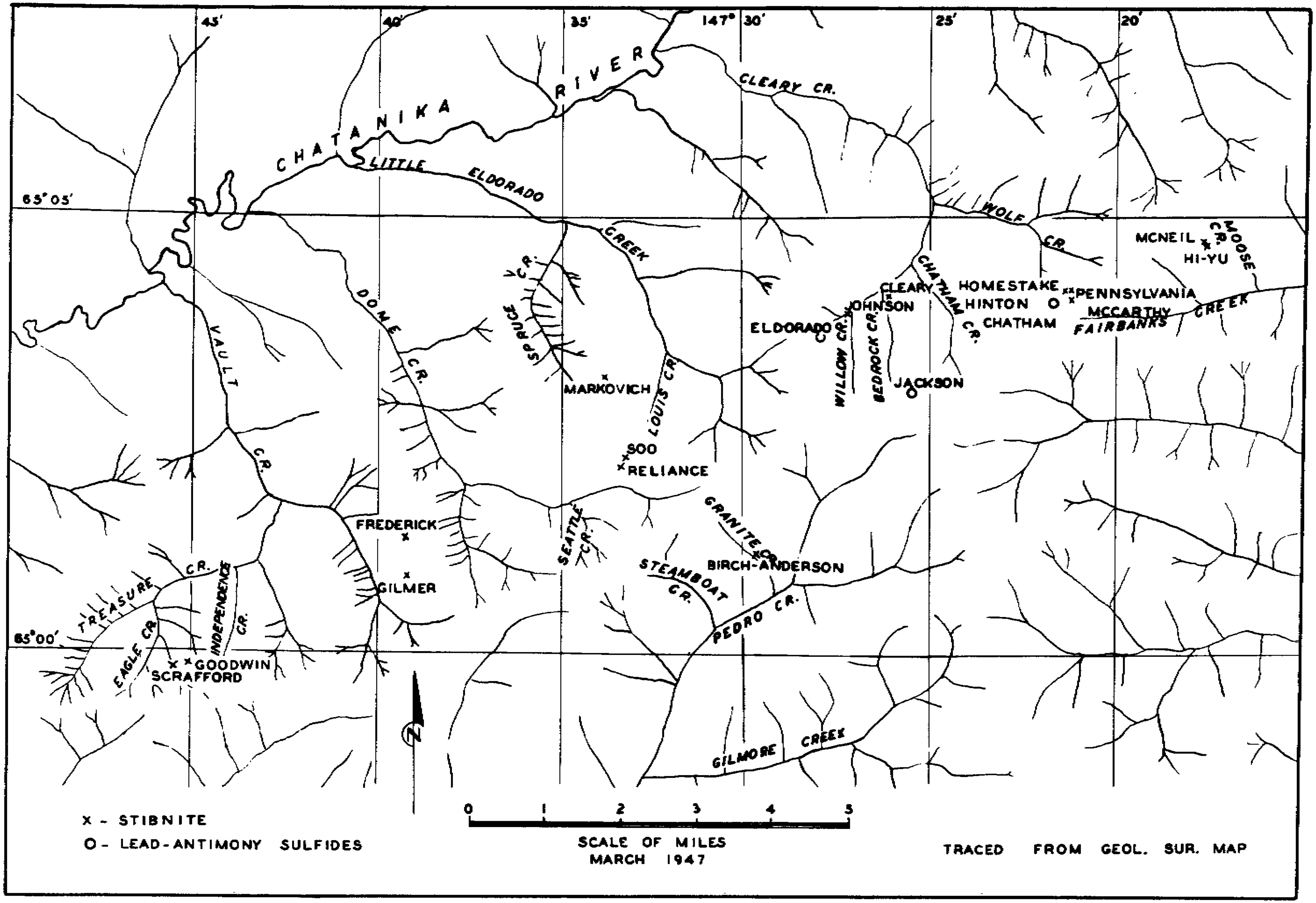

Figure 18. - Sketch map showing location of antimony deposits in Pedro Dome area.

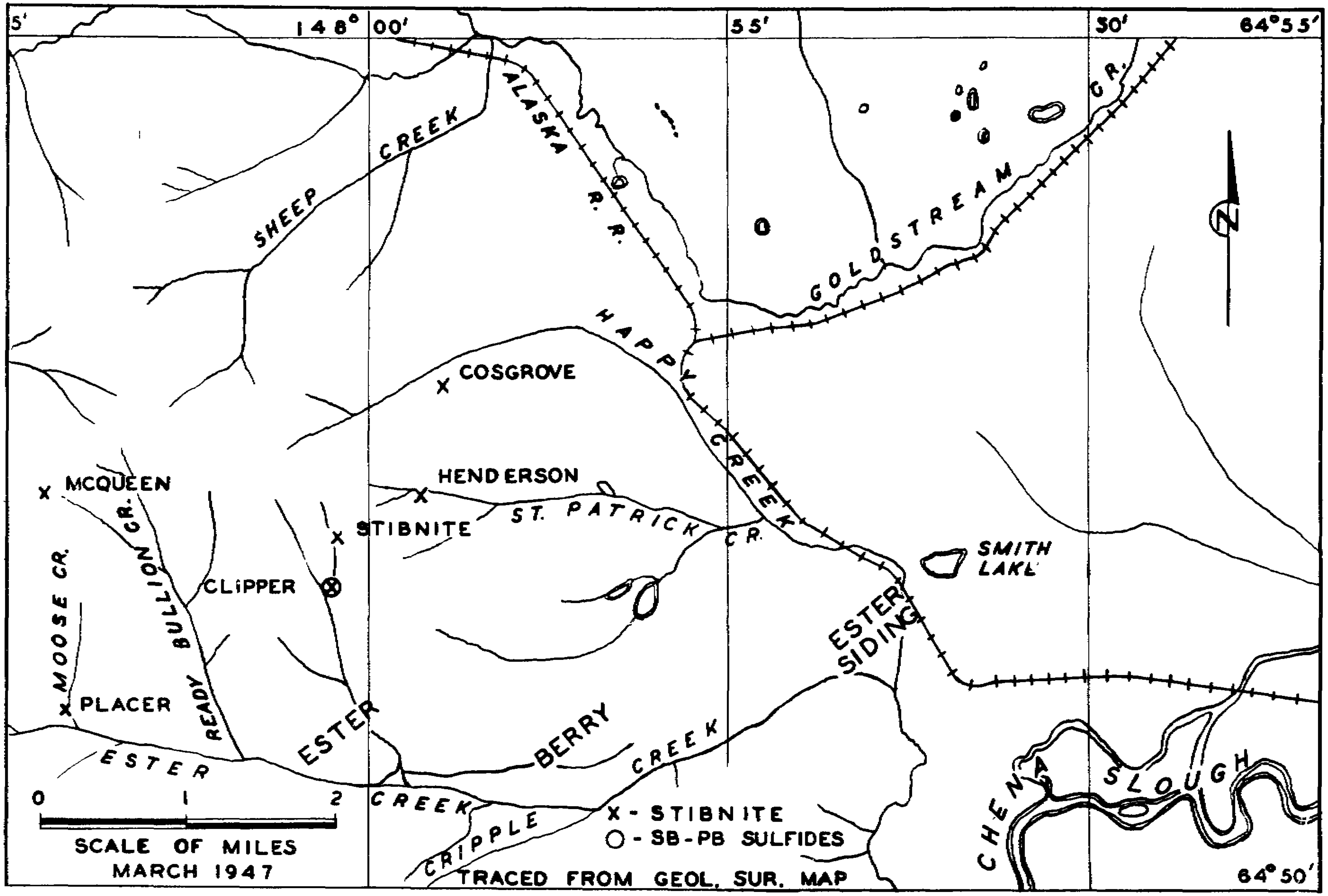

Figure 19. - Location of antimony deposits in Ester Dome area.

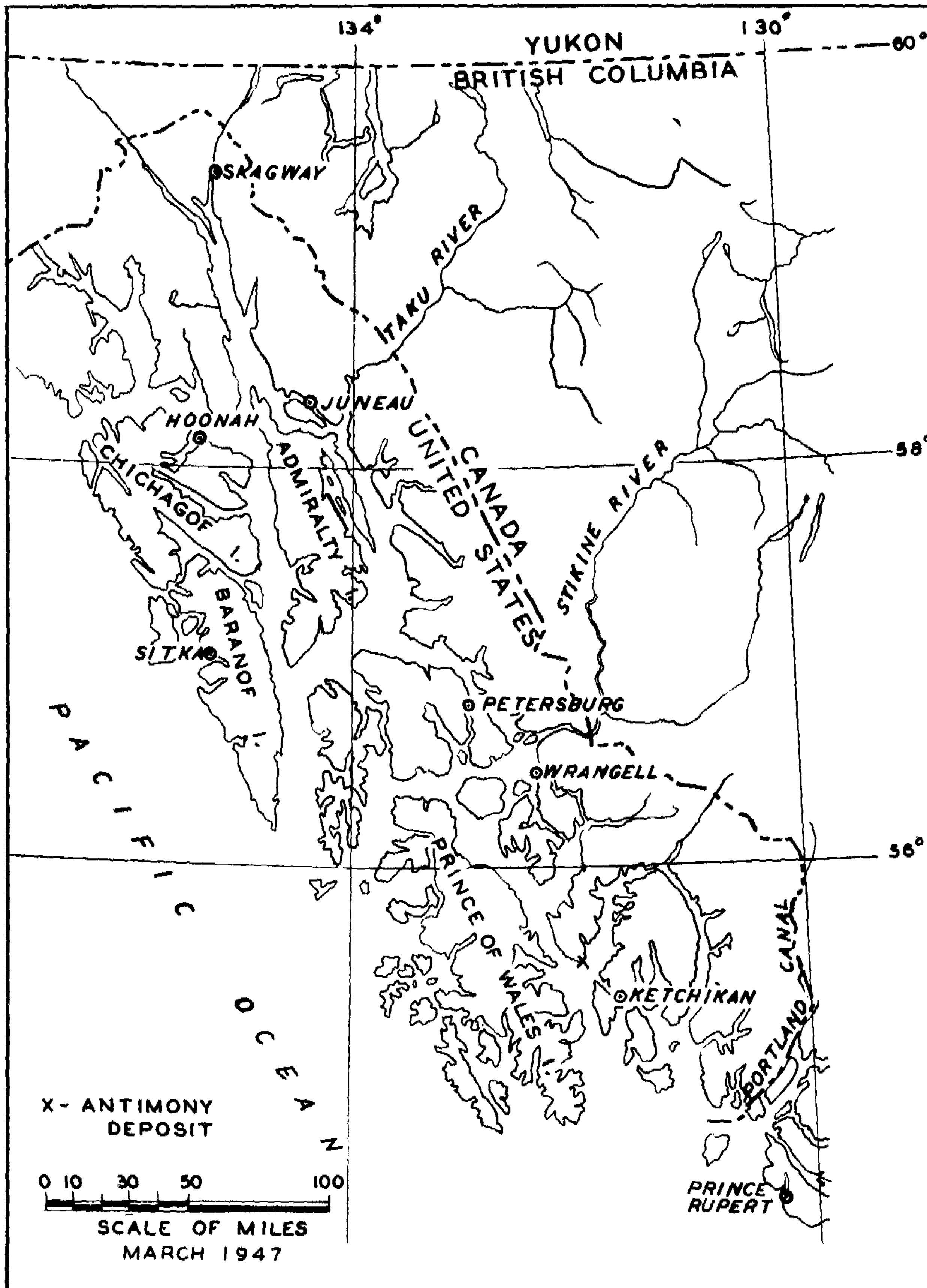

Figure 20. - Index map - Caamano Point antimony, S.E. Alaska.

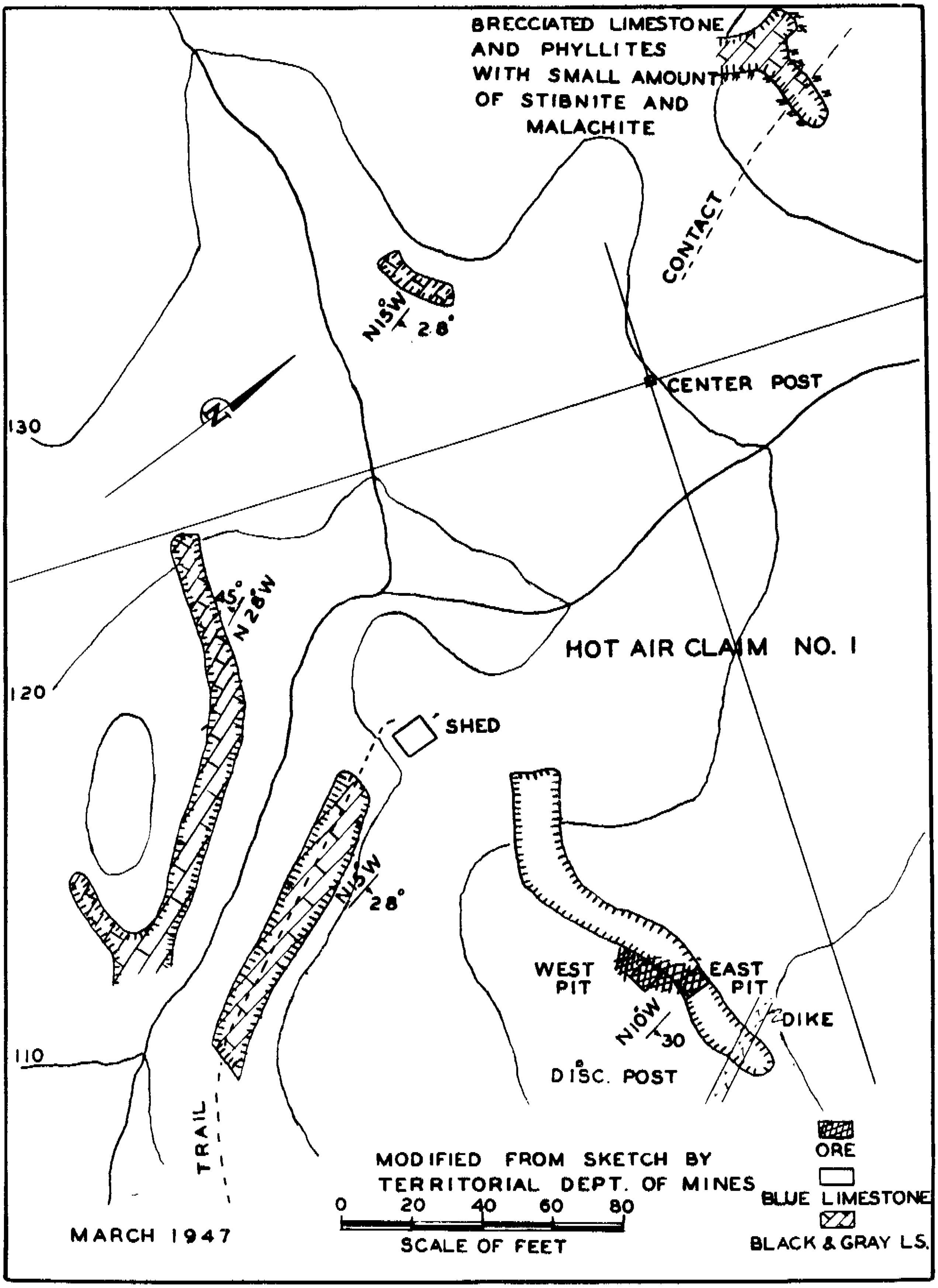

Figure 21. - Surface workings - antimony - Caamano Point.

CAAMANO POINT

Location and Accessibility

The property consists of two lode claims, the Hot Air and the Hot Air No. 1, and a millsite claim. It is on Caamano Point which is the most southerly point on Cleveland Peninsula, a portion of Southeastern Alaska mainland. The deposit is situated 1/2 mile northwest of the small bay on the east side of Caamano Point at 55° 31' N. latitude, 131° 59' W. longitude, and is 16 miles by water from Ketchikan, as shown on figure 20.

History

The property was discovered in 1914 by Val Klemm of Ketchikan, and it is understood that the annual assessment work has been kept up by him since that time.

Physical Features

The deposit is situated in a large, flat, brush- and timber-covered lowland at an altitude of 130 feet. A good trail connects the workings with the cabins on the millsite claim at the beach.

Description of the Deposit

The ore body is a small mass of high-grade stibnite cropping out over a strike length of 25 feet. The long axis trends about N. 70° W. and dips at 30° to the east. One small mass of stibnite was found about 10 feet west of the main body in the open cut. Mineralization is found in a brecciated blue limestone. The sediments have been folded and fractured. Twenty feet east of the prospect pit is a small, highly altered dike with a northwest strike. This dike appears to strike north with the sediments and to dip toward the ore body, and is expected to be encountered as the pits are deepened. It is mineralized with pyrite and low assays in gold reported.[10] The relationship of this dike to the stibnite ore shoots is not known.

About 250 feet northwest of the main body of stibnite an open cut uncovered some thinly bedded blue limestone in which weak stibnite mineralization can be found.

Mine Workings

The mine workings consist of five open cuts, a 12-foot and an 18-foot prospect pit sunk on the small body of high-grade stibnite. The two pits are 5 feet apart, as shown in figure 21. The west pit, which is the shallower of the two, cuts through the ore body, but the east pit is massive stibnite at the bottom, according to Geological Survey members who bailed it out.

10/ J. C. Roehm, associate engineer, Territorial Bureau of Mines.

The Ore

The principal ore mineral is massive stibnite with occasional specks of realgar and small amounts of quartz and calcite gangue. Some pieces of limestone and phyllite country rock are found in the ore.

One sample, cut on the east side of the westerly pit through a 33-inch width of ore, assayed 32.27 percent antimony.

The results on three samples cut by Roehm, Territorial Department of Mines are as follows:

Location	Description	Width, inches	Percent antimony
Bottom easterly pit, north wall	Massive stibnite and limestone.	42	25.67
Bottom easterly pit, south wall	Nearly massive stibnite.	52	48.82
Bottom westerly pit	Massive stibnite.	43	48.86

A shipment of 2,140 pounds of hand-sorted ore taken from the pits and shipped to the American Smelting & Refining Co. showed the following analysis: 14.8 percent insoluble, 0 percent iron, 0 percent zinc, 12.6 percent sulfur, 0.5 percent arsenic, and 44.8 percent antimony.

BLACK MOUNTAIN PROSPECT

This deposit is situated at latitude 61° 50' N., longitude 159° 20' W., near the summit of Black Mountain, which is about 1 mile distant from the right limit of the Owhat River, 18 miles airline from its confluence with the Kuskokwim River.

Beginning at the mouth of the Owhat River, the fourth peak defined by streams entering the right limit of the Owhat is Black Mountain. Its position relative to Molybdenum Mountain is shown on figure 22.

A sample representing the 50-foot central section of the vein showed the following analysis: 48.9 percent antimony, 0.02 ounce per ton gold, and 0.2 ounce per ton silver. This section has an average width of 2 inches. The vein fades out at about 75 feet beyond each end of this central section. The walls are not mineralized, and no parallel veins were found.

The vein is enclosed by shaly sandstone and roughly parallels a granite contact about 50 feet to the northeast. (See fig. 23.)

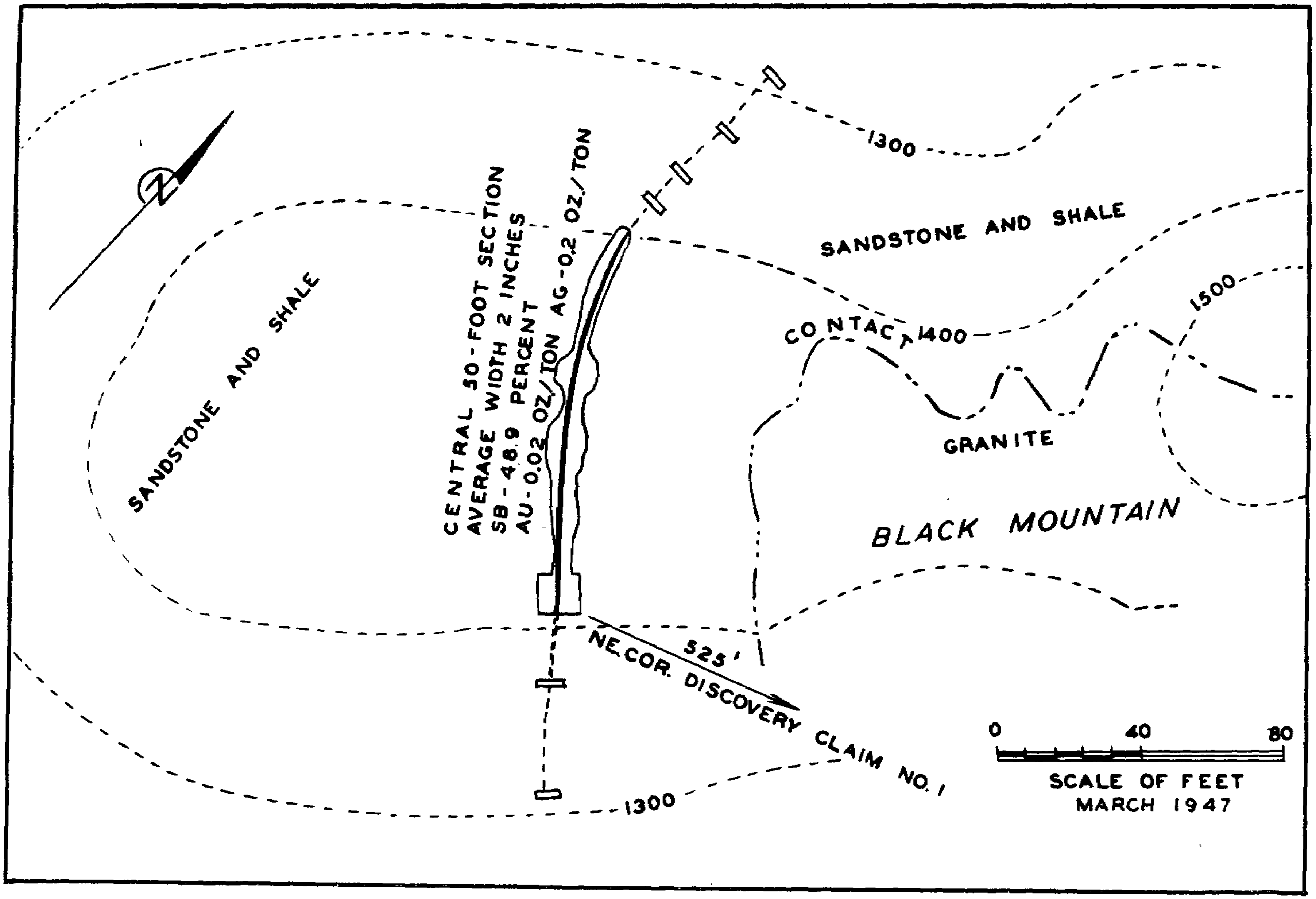

Figure 22. - Black Mountain antimony and Brink molybdenite prospects, S.W. Alaska.

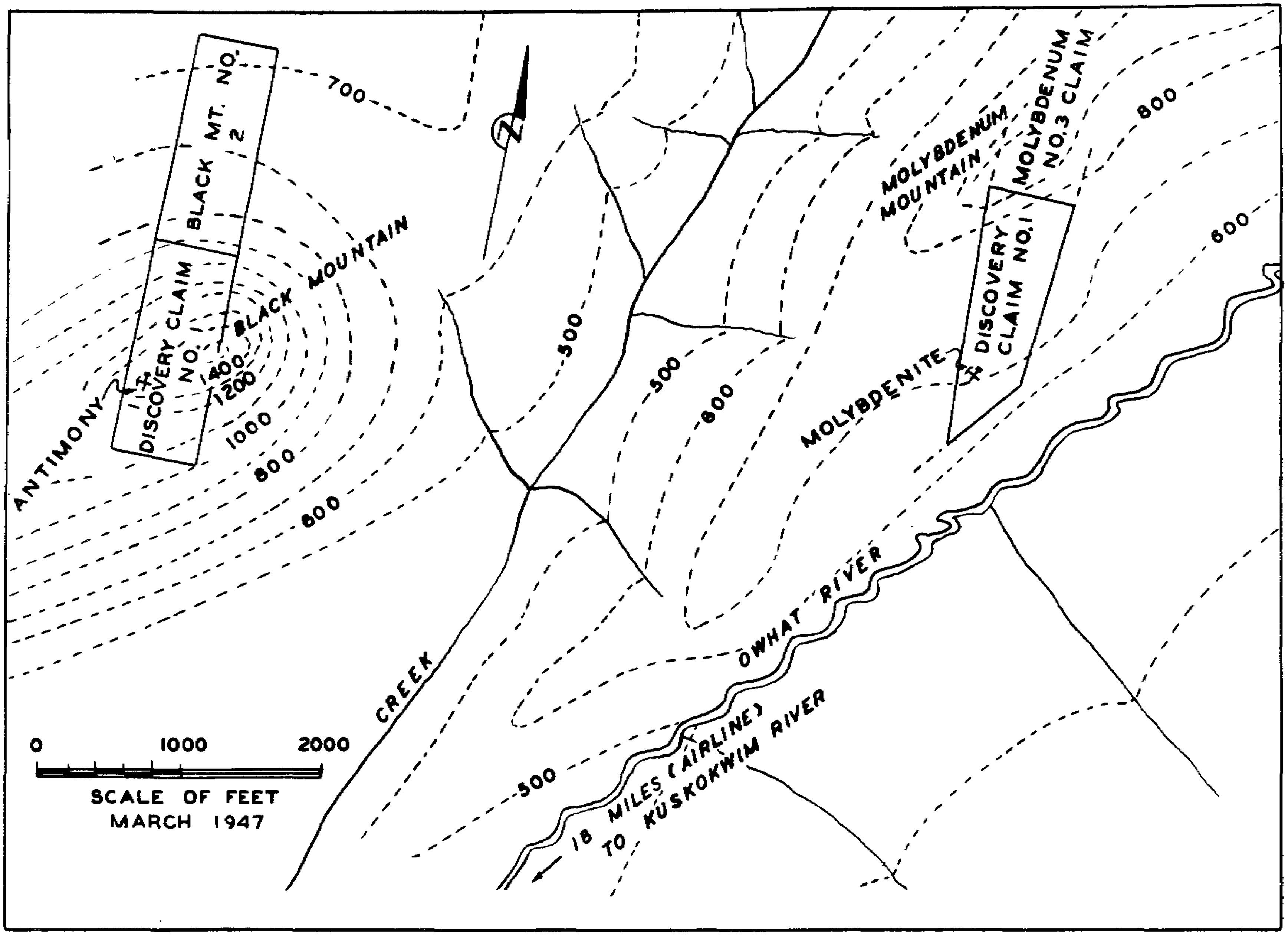

Figure 23. - Black Mountain antimony prospect, Owhat River region, Alaska.

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