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REPORT OF INVESTIGATIONS

EXPLORATION OF ARGENTIFEROUS LEAD-COPPER DEPOSITS
OF THE SLANA DISTRICT, ALASKA



BY

ROBERT L. THORNE

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INTRODUCTION

As an integral part of the investigation of critical and essential minerals in Alaska, the Bureau of Mines examined the lead deposits in the Slana area. Four examinations were made during June, July, and August 1945 in the 200-square-mile area immediately northwest of Slana. The settlement of Slana lies near the conflux of the small Slana River with the mighty Copper River less than 60 miles southwest of Tek Junction on the Alaska Highway.

Travel through the area and the examination of the properties were conducted by a three-man crew consisting of the author, a caterpillar operator, and a laborer. An RD6 caterpillar, equipped with blade and winch, was used in breaking trail and freighting through the country. Supplies and equipment were loaded on a 7- by 14-foot, double-end, go-devil, which was hauled by the tractor.

^{1/} The Bureau of Mines will welcome reprinting of this paper provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Report of Investigations 3940".

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The route followed to the Indian Group prospect was from 49 Mile on the Gakona-Slana road, parallel to Indian Creek, and then along East Indian Creek.

The Silver Creek prospect was examined by "packing in" a short distance from the highway.

In this report the properties examined in this area are described individually. The locations of the properties are shown in figure 1.

ACKNOWLEDGMENTS

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

Special acknowledgment is due Carl H. Whitam, manager of the Nabesna Mining Corp.; the Department of Mines, Territory of Alaska, for sample analyses; and R. S. Sanford, acting chief, Alaska Division, Mining Branch, for revision of the report.

LABOR, LIVING CONDITIONS, AND CLIMATE

Only one family resides within the 200-square-mile area in which the prospects are found, and Copper River Indians wander into this section on hunting, fishing, and trapping expeditions. Carl Whitam prospected the area during the summer of 1945, and one pack train of five men and eight horses made a trip to the Indian Group prospect. The Grubstake gold-placer property is usually operated by a few men in the summer months, but it has been closed during the war. Over the ridge from Grubstake Creek another placer property has been located on a right tributary of Porcupine Creek. This operation may bring a few men into the area.

A few miners can be employed from small settlements in the Copper River area, but a mine of moderate size would have to secure skilled labor from Fairbanks, Anchorage, Valdez, or Juneau. The Copper River Indians provide a source of common labor.

The lode deposits in this area were explored in the early nineteen-twenties. The properties have since been abandoned and relocated.

The Nabesna Mining Corp., with a crew of about 50 men, operated a gold-silver mine about 40 miles southwest of the Slana area during the nineteen-thirties.

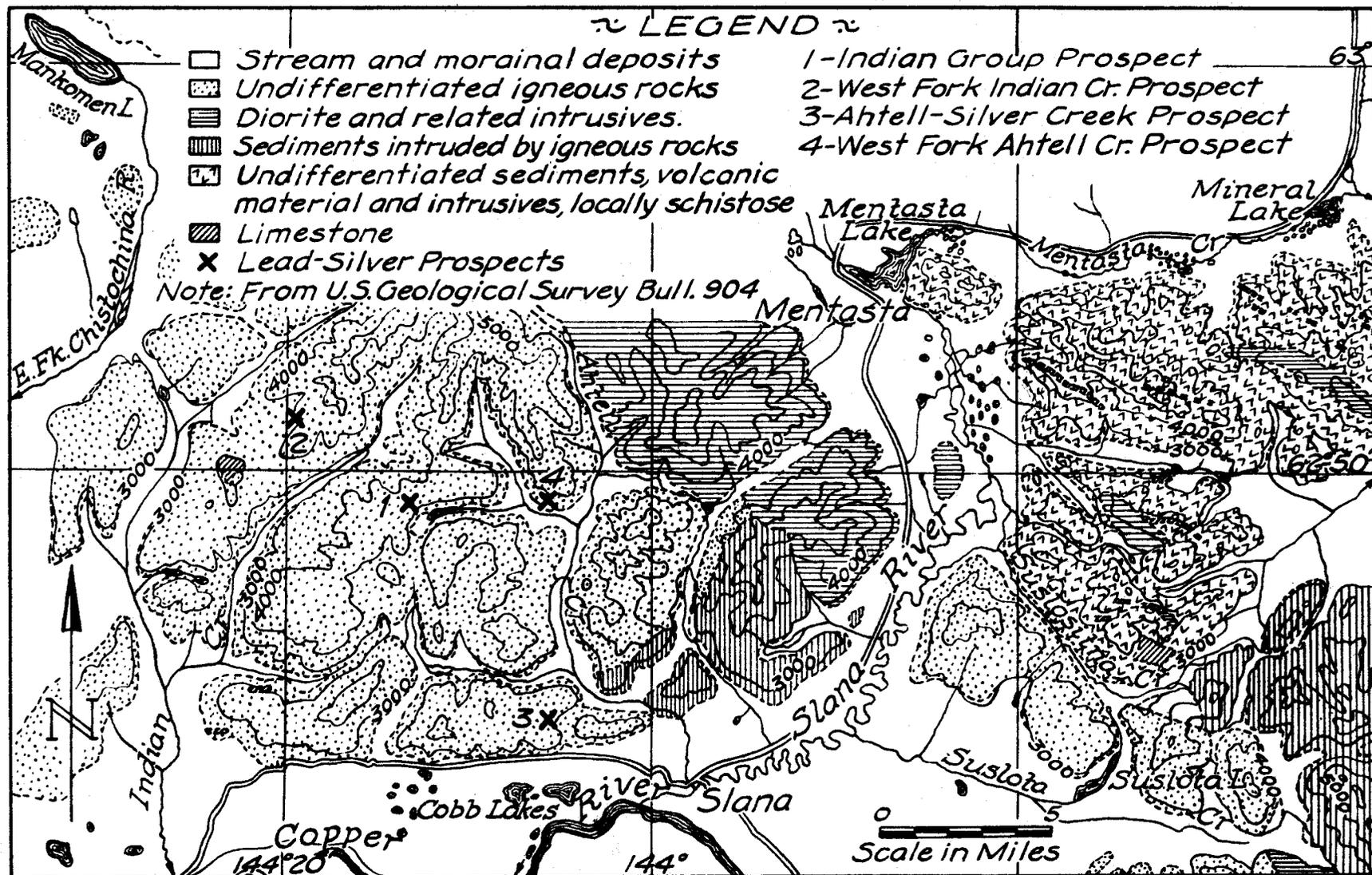


FIGURE 1.- Geologic map of Slana area, Alaska, showing location of lead-silver prospects.

The climate is typical of central Alaska and is characterized by long, cold winters and short, warm summers. Winter temperatures commonly drop to -50° F., and summer temperatures sometimes rise to 85° F. Rain and snowfall in the area are moderate to slight, but there was enough water for mining purposes at the properties examined.

INDIAN GROUP PROSPECT OR BLUE RIDGE LODE

The property is located at latitude $62^{\circ} 49'$ N. and longitude $144^{\circ} 13'$ W. The veins outcrop at the crest of a ridge which rises to an elevation of 4,800 feet, and mineralization has been traced by open-cuts down to an elevation of 4,400 feet.

The airline distance from the highway bridge on Indian Creek to the property is 13 miles. The shortest road route to the property would leave the highway 53 miles from the Richardson highway junction. The airline distance from the highway to the property on the Ahtell Creek drainage is less than 8 miles. A lake a mile long, situated a mile east of the property, makes access to the property by float plane possible.

Spruce timber is found in this vicinity to elevations of 3,200 to 3,400 feet, and the nearest stand is approximately $1\frac{1}{2}$ miles from the property. The trees have a maximum diameter of $1\frac{1}{2}$ feet and taper rapidly to a peak at about 30 feet. Above the timber, alder, willow, and black birch brush gradually gives way to open tundra, which, in turn, is displaced by talus on the steep slopes of the mountains. Altered, frost-shattered cliffs are common at higher elevations, but in the mineralized zone outcrops are found only at intervals along the main and spur ridges.

Carl Whitam relocated the property in 1944 and did additional prospecting there in 1945. The property is still in the prospect stage, with no development other than open-cuts and a trail from the head of the basin to the ridge.

According to Moffit^{3/},

The country rock is quartz diorite, which shows wide variations in texture but at the place where the vein was found is coarsely granular and contains large phenocrysts of feldspar. At this place the diorite is cut by a number of vertical fracture planes extending east and west and distributed over a distance of 100 or 200 feet from north to south. About 75 feet below the top of the ridge, which is 1,800 feet above Indian Creek, a quartz vein stands more than 6 feet above the ground and is at least 10 feet wide, although its boundaries are not exposed.

The large quartz vein mentioned above is barren of lead and copper minerals in exposures encountered from the ridge down to the talus in the western basin. To the east the vein is thoroughly covered with a coarse-grained,

^{3/} Moffit, F. H., Geology of the Slana-Tok District, Alaska; Geol. Survey Bull. 904, 1938, 54 pp.

igneous talus which contains predominantly pink feldspar, with hornblende and some quartz. The large quartz vein bounds the zone of deposition on the south. This vein outcrops on several spur ridges and in between has released large quantities of float which intermingle with the float of smaller mineralized and barren veins. The gangue mineral in all of the veins is predominantly a milky quartz containing scattered patches of cream calcite and some vugs lined with quartz crystals. The southern quartz vein narrows from more than 10 feet in width to 6 feet as it crosses the lowest spur ridge; and on the steep slope below it splits into two 3-foot veins separated by a 10- to 15-foot "horse" of country rock.

The first mineralized vein, between 4,300 and 4,400 feet in elevation, is encountered on the north side of the first gulch crossed by the trail. The gully was still covered with snow on July 15. An open-cut on the trail disclosed a barren quartz vein, and 15 feet up the gulch mineralized quartz appears on the dump of a caved open-cut. This cut was reopened and deepened several feet. At this point sample 1 was taken over a normal width of 2 feet across a vein containing galena, chalcopyrite, tetrahedrite, malachite, and azurite in a quartz-calcite gangue. Sample locations are shown in figure 2, and values are listed in table 1. Another open-cut was dug 35 feet east of cut 1, and the vein was encountered at a point where it had been cut and slightly offset by the barren vein encountered below cut 1. Cut 2 was sampled over a 2.5-foot width. Mineralization was very weak because of the breaking up of the mineralized vein and the inclusion of barren material. Cut 3 was excavated 50 feet east of cut 2 where a well-mineralized vein 1 foot in width was exposed and sampled. Mineralization was similar to that found in sample 1. The ore minerals are deposited chiefly in openings caused by secondary fracturing where galena, tetrahedrite, and chalcopyrite occur between the tips of well-formed quartz crystals. Small vugs occur at places in the ore. Three more open-cuts were put down to frost 30 to 50 feet east of cut 3. The open-cuts that covered a cross-strike interval of 25 feet encountered solid frost 18 inches below the surface. The bottoms of the cuts were in a mixture of coarse diorite talus and ice, and no reliable information was obtained from the work. A cut 60 feet west of cut 1 was excavated across the snowfilled gulch but failed to disclose the vein. Mineralized float was found 160 feet west of cut 1.

TABLE 1. - Indian group prospect samples

Sample	Width, inches	Oz. per ton		Percent	
		Gold	Silver	Lead	Copper
1	24	0.01	11.44	4.18	1.44
2	30	Trace	.40	.47	.12
3	12	Trace	5.16	6.81	.61
4	9	.04	15.56	19.92	.71
5	24	Trace	.38	5.24	Trace

A number of slightly mineralized and barren veins have been found farther north. Several caved cuts were cleaned out, but only one was sampled. Sample

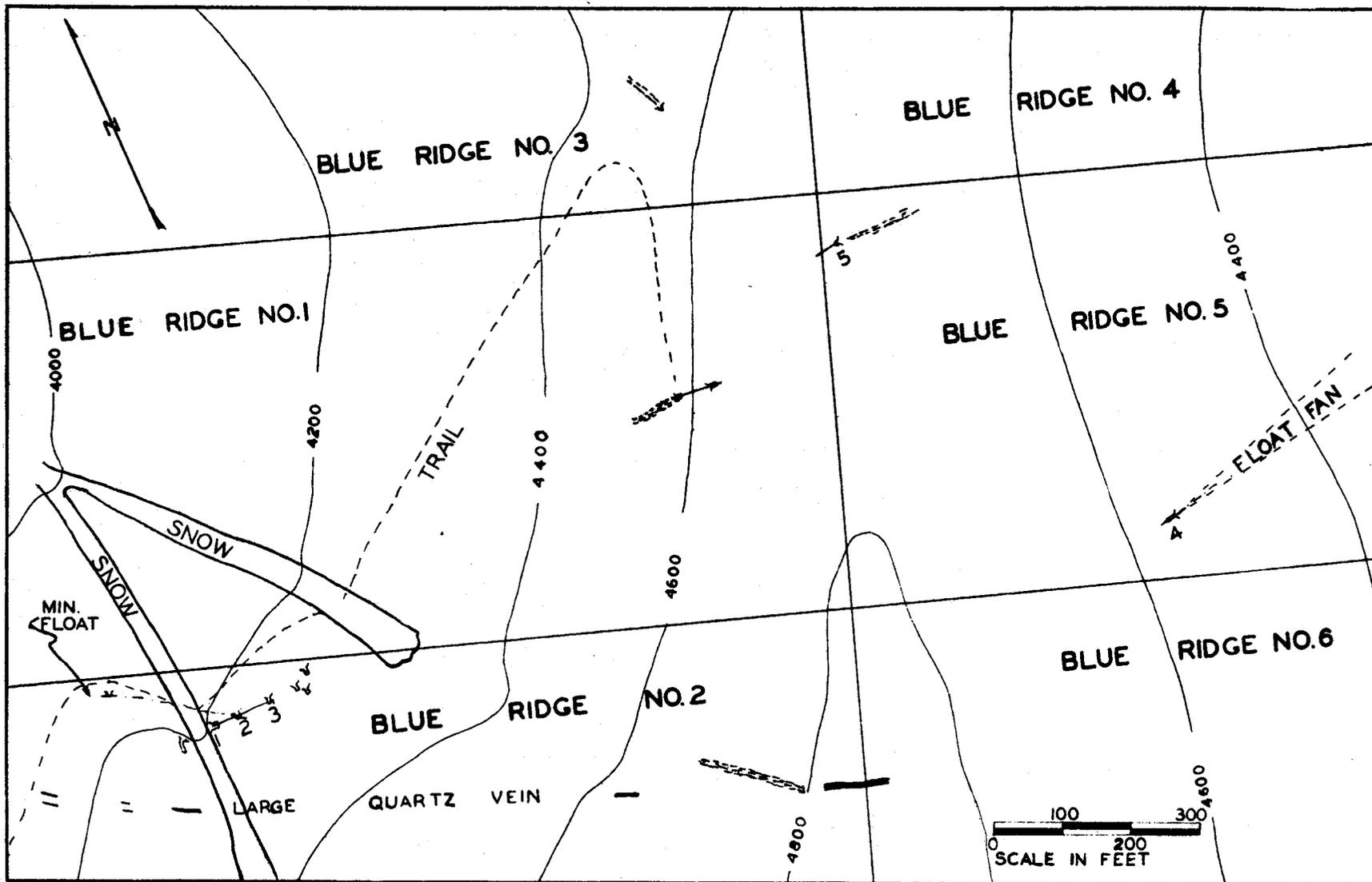


FIGURE 2.- Indian Group prospect, sketch map.

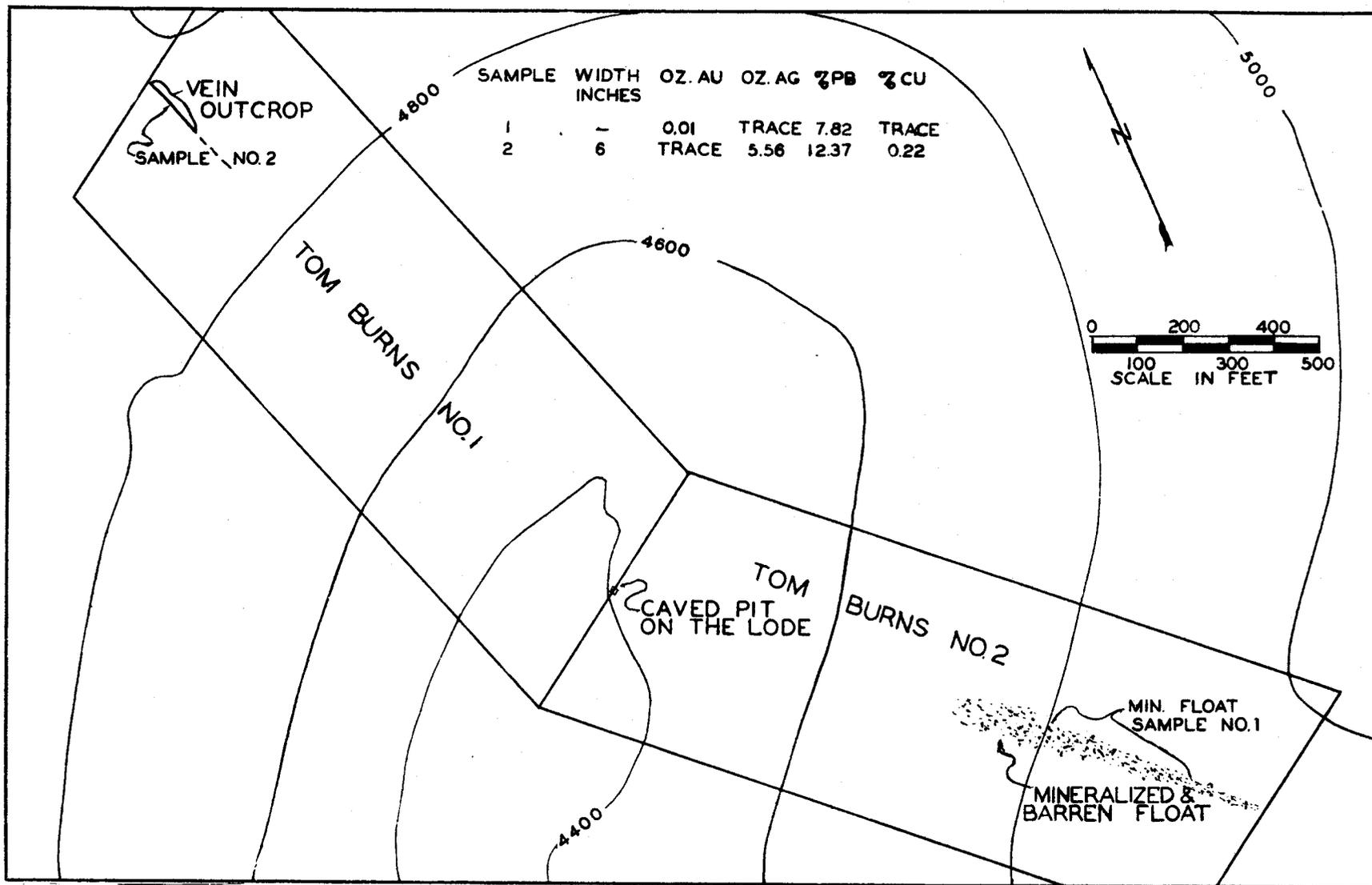


FIGURE 3.- West Fork Indian Creek prospect, sketch map.

5 was taken in a cut on the ridge between the Indian Creek and Ahtell Creek drainage. Further exploration indicated that the sample represented a small segment of a vein some 30 feet in length.

A new discovery was made by the Bureau of Mines on the east or lake side of the ridge by following a float fan to its apex and excavating a series of three open-cuts. The first cut was started 5 feet up the slope from the uppermost loose vein fragment and disclosed a float line 2.5 feet below the surface. The second cut, started 10 feet above the first, did not encounter float or the vein in place. The third cut (shown as Blue Ridge No. 4, fig. 3), located between the first two, disclosed at a depth of 4 feet a line of float that led to a 9-inch vein in place at a depth of 7 feet below the surface. The vein is well-mineralized, strikes N. 70° to 80° E., and dips 80° to 85° S. Above the discovery a diorite talus is so deep that the vein could be traced up the hill only with considerable difficulty. Below the discovery an abundant, well-mineralized float fan spreads out along the strike for a horizontal distance of 250 feet. The abundance of float indicates continuance of the vein for some distance down the slope, and the topography presents an excellent opportunity for exploration.

Exploration has been confined to portions of the surface exposures of a few veins, and much more work would be required for thorough analysis of the property.

WEST FORK INDIAN CREEK PROSPECT

The West Fork Indian Creek prospect is on the west fork of Indian Creek drainage, 3.5 miles in an airline northwest of the Indian Group prospect. The best route to the property lies up the east fork of Indian Creek and across a low divide. The trail distance from the road would be between 15 and 16 miles. The location is shown on figure 1.

In 1945 Carl Whitam relocated this property, formerly known as the Silver Circle, and renamed it the Tom Burns. The locator acted as guide and furnished horses for the examination.

Mineralization was examined in three exposures on the property. A discovery pit had been sunk on a vein at the top of a small dome near the center of the valley. The pit had caved, but enough evidence was available to determine the nature of the mineralization and the location of the vein in place. Near the ridge on the northern side of the semicircular valley the vein outcrops over a 60-foot length. A sample of the mineralized portion of the vein was taken from this outcrop. On the southern slope of the valley mineralized and barren float was traced to the ridge and sampled. A cut started on frost-broken quartz near this ridge did not reach a point where the quartz was undisturbed. Although the vein has been located in only three places, at 1,500-foot intervals, there is evidence which suggests that the showings are on the same vein.

The vein, where exposed, is milky quartz 2 to 8 feet wide. Minor secondary fracturing has provided a channel for later mineralization. Mineral deposits in the quartz vein usually occur on one or both walls and are from a few

inches to nearly a foot in width. From the outcrop near the north ridge a 1-inch to 3-inch, highly mineralized stringer was traced 50 feet into the hanging wall of the main vein. Sulfide mineralization in all of the exposures and in the float, is predominantly galena, with minor quantities of chalcopyrite and tetrahedrite. The gangue mineral associated with the sulfides is quartz, very similar in appearance to that composing the barren portion of the vein.

Sample 1 was taken from the mineralized float on the southern slope to obtain a rough estimate of the metal content of the mineralized portion of the vein in that area. Sample 2 was cut across the mineralized 6 inches of a 2.5-foot vein near the northern ridge. Sample results are shown in table 2 and in figure 3.

TABLE 2, - West Fork Indian Creek prospect samples

Sample	Width, inches	Oz. per ton		Percent	
		Gold	Silver	Lead	Copper
1	Min. float	0.01	Trace	7.82	Trace
2	6	Trace	do.	12.37	0.22

WEST FORK AHTELL CREEK PROSPECT

The prospect is at the foot of a mountain on the north side of the west fork of Ahtell Creek, $1\frac{1}{2}$ miles above the junction with the main creek. At an elevation of 3,400 feet, the property lies on the slope above the last scattered stand of spruce timber. The location is shown in figure 1.

The Neverseat lode claim, covering this property, was located July 7, 1943, by Noel M. Routsen and William Wallace.

The lower tunnel is approximately 100 feet higher than the creek and is now open for 10 feet to a cave from the surface. A crude bunk and other evidence show that this was last used as living quarters. The diorite country rock shows blocky fracturing. A quartz stringer 2 inches to 3 inches wide, in fractured diorite, is weakly mineralized with galena and chalcopyrite.

The upper tunnel, 17 feet long, is 100 feet above and 300 feet N. 10° E. of the lower tunnel. In driving the tunnel, about 200 pounds of high-grade ore has been extracted and collected on the dump. The last round blasted had been left in the face and was "mucked" out during this examination. The tunnel was driven on a shear zone 6 feet in width, containing three mineralized quartz veins, each with a strike of N. 15° E. and a dip of 70° W. Sample 1 was cut on the sill 16 feet from the portal and includes the central and hanging-wall quartz veins in its 42-inch width. Sample 2 was also a sill sample cut 11 feet from the portal over a width of 40 inches. This sample includes the central and footwall quartz veins and is highly oxidized, as is the remaining shear-zone rock between this point and the portal. Sample results are shown in table 3.

TABLE 3. - West Fork Ahtell Creek prospect samples

Sample	Width, inches	Oz. per ton		Percent	
		Gold	Silver	Lead	copper
1	42	0.01	Trace	6.58	0.19
2	40	Trace	Trace	1.48	.31

Much of the mineralization indicates open fracture deposition with galena and a limited amount of chalcopyrite deposited between quartz crystals up to $\frac{1}{2}$ inch in diameter. In the fracture zone, some evidence of oxidization is exposed by stains of malachite, chrysocolla, and limonite as far as the face.

The area in which the two tunnels are located is covered with dense brush and heavy overburden which would make surface exploration difficult.

About $\frac{3}{8}$ mile northeast of the upper tunnel, a creek has cut a deep wash into the mountain and exposed an excellent place for prospecting along the strike. A mile southeast of the prospect and in line with the general strike of the shear zone, ore similar to that found at the upper tunnel was reported.

SILVER CREEK PROSPECT

The Silver Creek prospect is on the north side of Silver Creek, slightly more than a mile above the point where it flows into Ahtell Creek. The distance from the highway at 59 Mile is slightly more than a mile, and a road or trail to the property need be no more than $1\frac{1}{2}$ miles in length. The prospect is at an elevation of 2,900 feet, and a road to the prospect could be constructed which would lie between elevations of 2,800 feet and 3,000 feet.

A stand of large spruce trees grows near the creek between its junction with Ahtell Creek and a point $\frac{1}{4}$ mile upstream from the prospect. In the section of the creek valley occupied by the prospect, a spur ridge south of and 80 feet above the creek has caused a short, narrow canyon to be formed.

A fault zone 100 feet or more in width crosses the canyon in a northwest direction. Exploration was started by prospectors years ago on three quartz veins in this zone. Other veins may be present.

Two adits, now caved, had been driven on the western quartz vein. The adit portals are 61 feet apart horizontally and 39 feet vertically. At the upper portal a vein outcrops for 20 feet. Above the portal the vein is 3 feet wide, and a secondary fracture 1 inch in width contains galena. The adit at the outcrop was driven in the footwall adjacent to the quartz vein where there may have been additional mineralization. No samples were taken on this vein.

The centrally located quartz vein is exposed for 15 feet vertically by an open-cut and for an additional 15 feet by an inclined shaft. The quartz vein, which occupies a zone of heavy shearing, increases in width from 1 foot near

the surface to 3.5 feet at a point 10 feet down the shaft. The vein is vertical and the shaft was sunk at a 50° angle to the northwest. The vein strikes N. 60° W. Sample 1 was cut 10 feet below the collar of the shaft; sample 2, 5 feet below the collar; sample 3, at the collar; and sample 5 on the footwall 5 feet above the collar. The vein is sparsely mineralized with tetrahedrite and galena in a quartz gangue.

The easterly vein was exposed 35 feet southeast of the shaft by an open-cut. About 25 feet down the strike from this cut is an old caved cut. In the upper cut, sample 4 was taken over a 2-foot width of hard quartz carrying minerals similar to those in the shaft.

The country rock in the area outside the fault zone is an unaltered, dark gray, hard, moderately coarse grained, hornblende diorite. The rock in the fault zone has been altered to a white, soft material containing highly altered feldspars and fresh pyrite. No hornblende was found in the subsurface rock and on the surface the pyrite has been altered to red ferric oxide. Sample analyses are shown in table 4 and in figure 4.

TABLE 4. - Silver Creek prospect

Sample	Width, inches	Oz. per ton		Percent	
		Gold	Silver	Lead	Copper
1	42	Nil	Trace	0.66	Trace
2	18	0.02	7.46	.17	.88
3	12	Trace	17.50	.12	1.59
4	24	.04	Trace	.10	Trace
5	12	Trace	4.36	0.15	.34

MINERAL POINT PROSPECT

At 37 Mile, a point on the Tok road 37 miles northeast of Slana, a mineral discovery was reported by Fred Bronniche as possibly a nickel occurrence. Monuments were seen, which showed that the property had been located, but the discovery notice was not found.

The mountain on which the mineralization was discovered lies north of the road and can be identified by two peaks of white limestone separated by a saddle of reddish rocks. East of the western peak, argillitic rocks are exposed for several hundred feet. The argillite gives way to a granitic dike nearly 100 feet wide, which abuts the limestone of the eastern peak.

At the top of a talus deposit, a shear zone 6 feet in width traverses the argillite in a N. 65° W. direction toward the limestone at the summit. Much of the rock in the shear zone has been altered to a reddish-yellow material that continues to some depth. Sample 1 was cut through an unaltered section containing a fine-grained, steel-gray mineral abundantly disseminated through a fine-grained quartz. On pounding, the mineral gave off the garlic odor characteristic of arsenic and physically resembled arsenopyrite; however, the same

SAMPLE	WIDTH INCHES	OZ. AU	OZ. AG	PERCENT PB	PERCENT CU
1	42	NIL	TRACE	0.66	TRACE
2	18	0.02	7.46	.17	0.88
3	12	TRACE	17.50	.12	1.59
4	24	.04	TRACE	.10	TRACE
5	12	TRACE	4.36	.15	.34

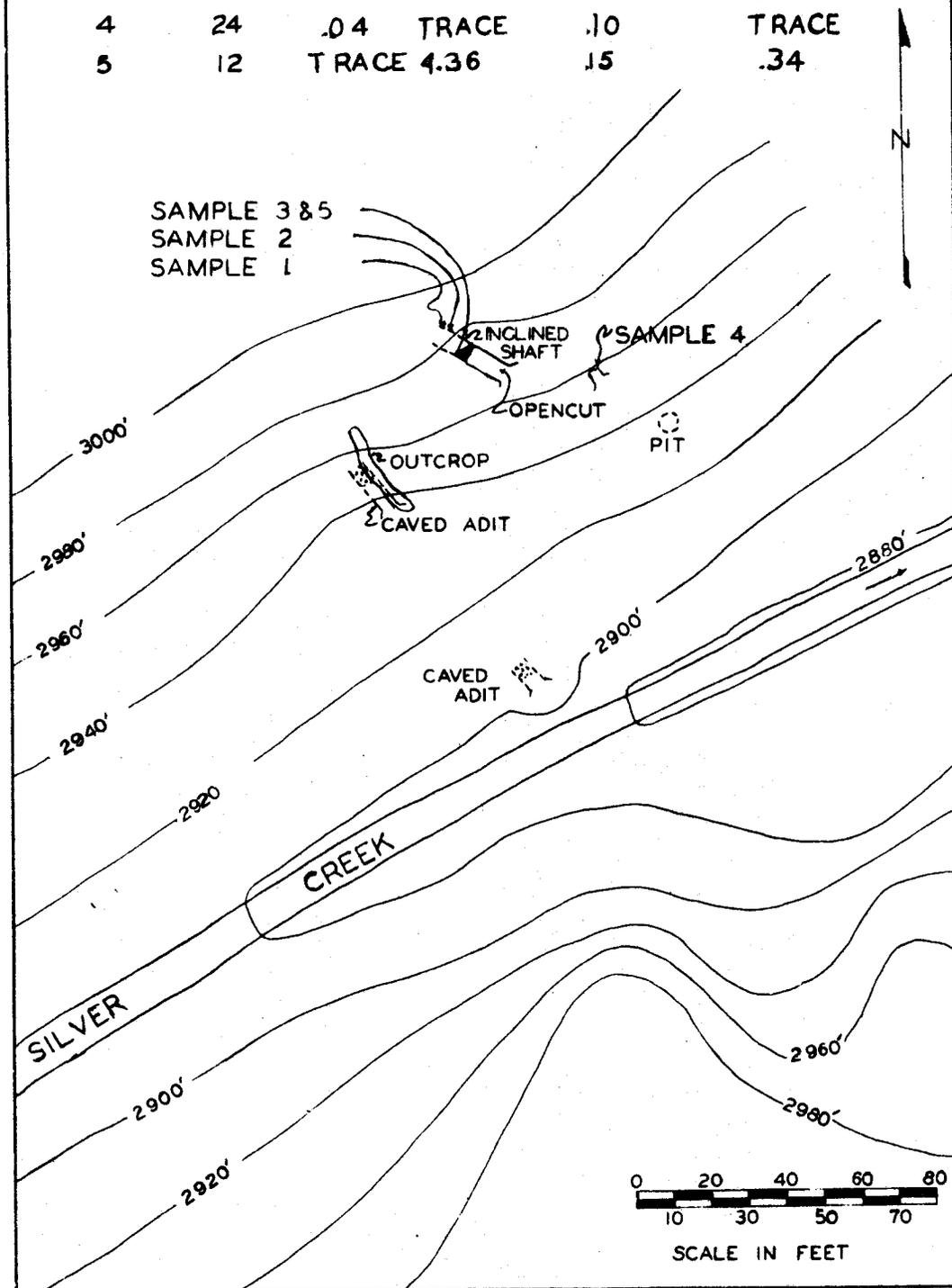


FIGURE 4.- Silver Creek prospect, sketch map.

characteristics apply equally well to the nickel ore, smaltite. Evidence of the trend of the vein is exposed for nearly 100 feet above the talus.

On the talus slope, about 100 feet east of the shearzone, float from a vein about 1 inch wide was found. The float contained, in a more massive form, the steel-gray mineral found in the shear zone and in places was stained apple green, characteristic of several nickel arsenates.

The following table indicates, however, that neither of the samples contained more than a trace of nickel.

TABLE 5. - Mineral Point prospect

Sample No.	Place	Oz. per ton		Percent	
		Gold	Silver	Copper	Nickel
1	Shear zone	Trace	Nil	0.28	Trace
2	Float	0.11	3.98	.18	do.