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

BUREAU OF MINES
JAMES BOYD, DIRECTOR

REPORT OF INVESTIGATIONS

INVESTIGATION OF THE MORELOCK CREEK TIN PLACER DEPOSITS, FORT GIBBON DISTRICT, ALASKA

BY

BRUCE I. THOMAS AND W. S. WRIGHT

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By Bruce I. Thomas[2] and W. S. Wright[3]

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INTRODUCTION AND SUMMARY

In 1943, the Bureau of Mines investigated the occurrence of cassiterite in the gravels of Morelock Creek which flows into the Yukon River 32 miles east of the confluence of the Yukon and Tanana Rivers in central Alaska.

Samples of the gravels were obtained by churn drilling, test pitting, shaft sinking, and open-cut mining. The gravels along Morelock Creek are about 6 feet in depth and covered with about 2-1/2 feet of overburden. The overburden is frozen, but the underlying gravels are not. Cassiterite, with gold and other heavy minerals, is usually concentrated in the first 2 feet of gravel above bedrock and in some places penetrates into joint planes in the bedrock.

The various methods of obtaining samples are discussed, and drill logs and analyses are tabulated in this report.

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 Investigation 4322."

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Special acknowledgment is extended to Edward Vogt, owner of the Morelock Creek claims, for supplying the Bureau with various small tools and housing facilities for the project crew.

LOCATION AND ACCESSIBILITY

Morelock Creek is at longitude 151° W. and latitude 65° 18' N., about 32 miles east of the confluence of the Yukon and Tanana Rivers. The nearest settlement is Tanana, with a population of about 150 people - 50 whites and 100 Indians. Tanana has two general stores, a roadhouse, an air field capable of accommodating large aircraft, a territorial school, a government-operated hospital, and a church. Freight is brought in from the coast by railroad to Nenana, then by river via Tanana to Morelock Creek. In the winter, travel is by dog team or airplane. During the winter months planes can land on the Yukon River at the mouth of Morelock Creek whenever the ice freezes smoothly enough for skiis.

PHYSICAL FEATURES AND CLIMATE

The area is north of the Yukon-Tanana upland and is characterized by high, well-rounded hills. The average relief is about 800 feet.

The climate of the region is typical of central Alaska; winters are long and cold and summers short and relatively warm. Temperature ranges from -70° F. in winter to 90° F. or higher in summer, with an annual mean of about 23° F.

A considerable portion of the alluvial deposits is permanently frozen - only a few feet at the surface thaw during the summer. A marked exception of this condition exists on Morelock Creek, where circulating ground water has thawed the ground in places for a considerable distance back from the banks.

The annual precipitation recorded for the last 30 years averages 12.98 inches. The average winter snowfall, based on observations over the same period, is 53.6 inches. The frozen mantle of upper gravels and moss has a tendency to restrict ground-water circulation. In summer the moss retards the run-off and holds much of the precipitation near the surface.

The more common trees growing along the valley floor on the thawed areas are spruce, cottonwood, and birch, with some dwarf willows and alders. Scrub spruce and moss grow in the permanent frost areas. Willows and alders, among spruce and some birch, are the predominant growth on the high benches and valley slopes.

In some areas of the valley floor there are fairly large patches of spruce that attain a diameter of 2 feet or more, which would be suitable for saw logs.

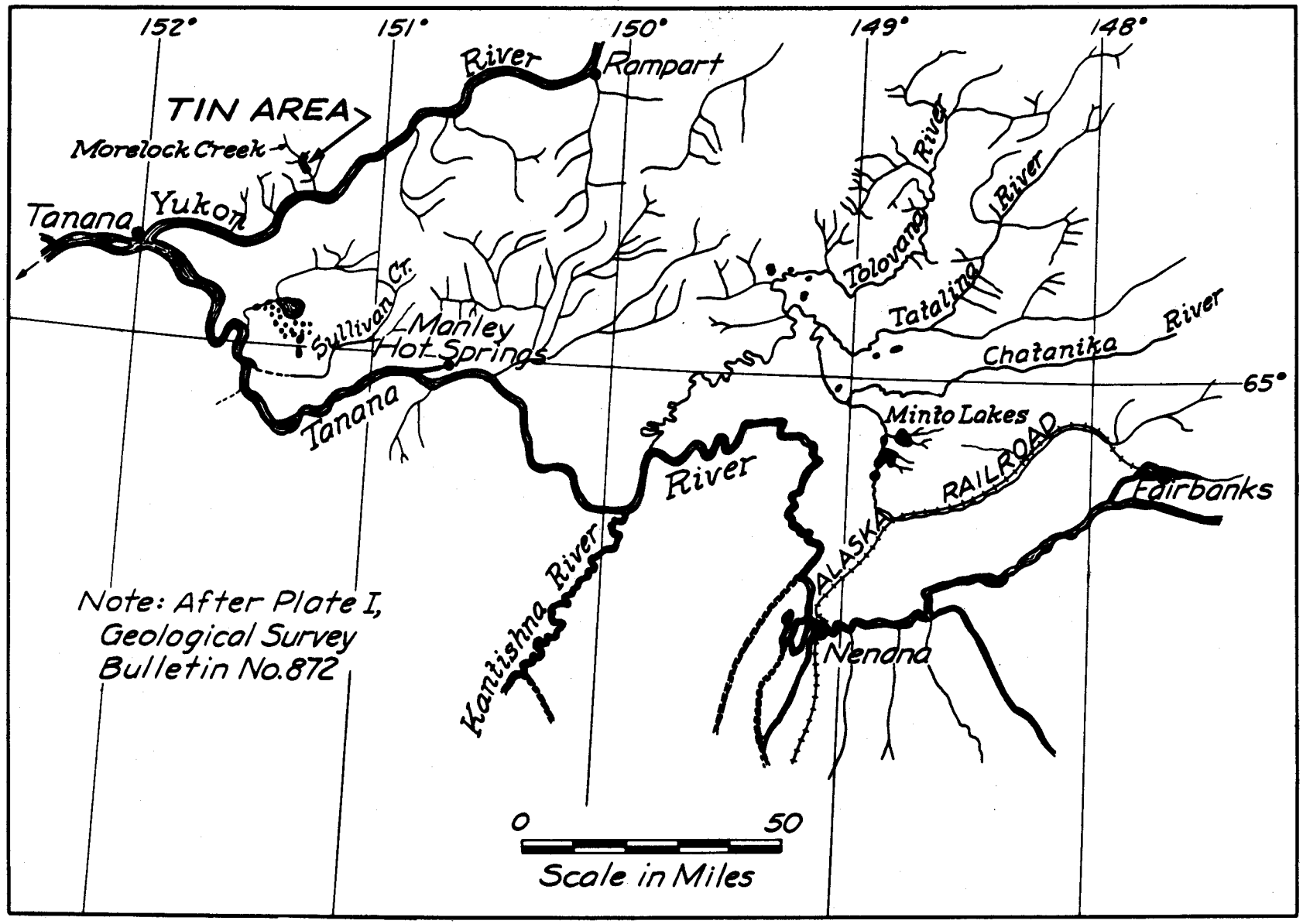

Figure 1. - Morelock Creek tin area, central Alaska.

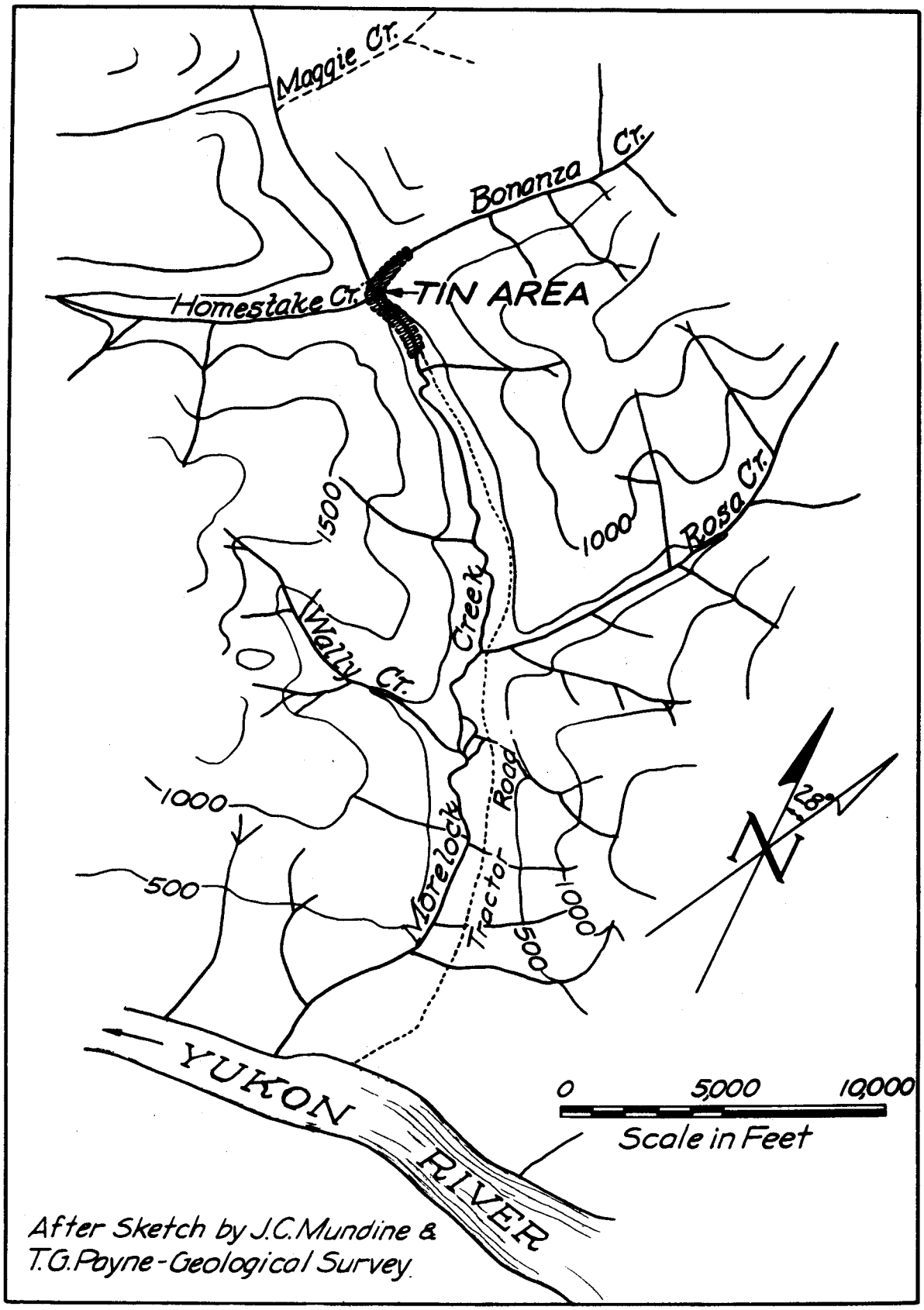

Figure 2. - Morelock Creek.

HISTORY AND PRODUCTION

Placer gold was first discovered on Morelock Creek in the fall of 1901; as a result, many men stampeded into the area from the Rampart district. All mining was done by hand, and operations were chiefly confined to the exposed reefs, where the shallow portions of the deposits were found. Gold was never found in sufficient quantities to make the area a large producer, and activities soon died down. Since that time various parties have prospected in the district, but all have been unsuccessful in finding any large areas of minable ground.

Vogt has been in the district about 10 years and has been mining virgin ground on the high reefs. It was through his efforts that attention was given to Morelock Creek as a possible source of tin.

Ten 20-acre placer claims covering the tin-bearing area are held by Vogt. All these claims are recorded at the Fort Gibbon recording office at Tanana, Alaska.

WATER SUPPLY

There is enough water in Morelock Creek to satisfy the demands of a small placer-mining operation. During the lowest stages, it is estimated that approximately 500 miners inches of water flow through the tin-bearing area. After heavy rains such as occurred at various times during the period of investigation, the flow of water was observed to have increased several times that of the low stage.

Two small ditches, built several years ago, supply water for hand-mining operation. These ditches are too small and are not properly located to furnish water for any mechanized operation of the deposits.

OCCURRENCE OF DEPOSITS

The tin-bearing area on Morelock Creek is about 5-1/2 miles from the Yukon River. Figure 1 shows the location of the Morelock Creek tin area, and figure 2 is a more detailed sketch of Morelock Creek.

Tin, in the form of cassiterite, is found in the gravels on Morelock at the mouth of two small tributaries - Bonanza and Homestake Creeks. It is in this area that the greatest concentration of cassiterite, with gold, is found, smaller amounts of both occurring in the gravels that extend downstream for a distance of 3,000 feet.

The valley floor below Bonanza Creek is about 600 feet in width. The hills on the west side of the valley rise rather steeply, but those to the east slope more gently, and a bench paralleling the creek indicates an old valley floor. This bench begins at the confluence of Morelock and Bonanza Creeks and extends the full length of Morelock valley to the Yukon flats.

Bedrock in the tin-bearing area consists mostly of metamorphic rocks. In the area prospected, quartz-sericite schist, greenstone schist, calcareous schist, and quartzite schist were observed. Near the lower end of the area, a bed of limestone outcrops along the east bank of the creek. These rocks are complexly folded and faulted, producing an irregular surface upon which the gravels have been deposited. Although it is apparent that the source of the tin is not local bedrock, the bedrock had a definite influence on the deposition of tin in the area. The complex folding and faulting, combined with the erosion of less resistant rocks, has produced, in most places, an irregular bedrock surface. It is upon these irregularities or "reefs" that the gold and heavy minerals such as cassiterite, magnetite, pyrite, and limonite, were deposited.

CHARACTER OF DEPOSITS

The gravels in the area prospected are about 6 feet in depth and are covered with overburden for an average depth of 2-1/2 feet. This veneer of overburden, composed chiefly of organic matter, is frozen, although the underlying gravel is not. Some of the gravel along the outer rim of the valley was found to be frozen, but this condition seems to exist only along the margins of the alluvium. The gravel is fairly coarse and contains many boulders, some of which are 24 inches in diameter.

The tin mineral and gold, together with other heavy minerals, are usually concentrated in the first 2 feet of gravel above bedrock, but in places the minerals penetrate the sediment-filled joint planes in the bedrock.

EXPLORATION BY THE BUREAU OF MINES

During the investigation, four methods were used to obtain samples from the placer deposits - churn drilling, test pitting, caisson shaft sinking, and open-cut mining.

Churn Drilling

Drill holes were spaced 100 feet apart in two lines across the valley. The lines crosscut the tin-bearing area, and the purpose of the work was to determine the possible extent of the deposit up and down the valley as well as across the width.

Location of drill holes is shown on figure 3. After a hole was drilled, a permanent stake, on which the line and hole numbers were painted, was placed in it. These stakes protruded 6 to 7 feet above the ground so that they could be found easily. Sections through each line of holes are shown on figures 4 and 5.

A small, portable, 5-inch, airplane-type churn drill was used. In thawed ground, a 5-inch casing with a 6-1/4-inch drive shoe and a thin placer bit was used. The drill crew was composed of a driller, helper, and panner or sampler.

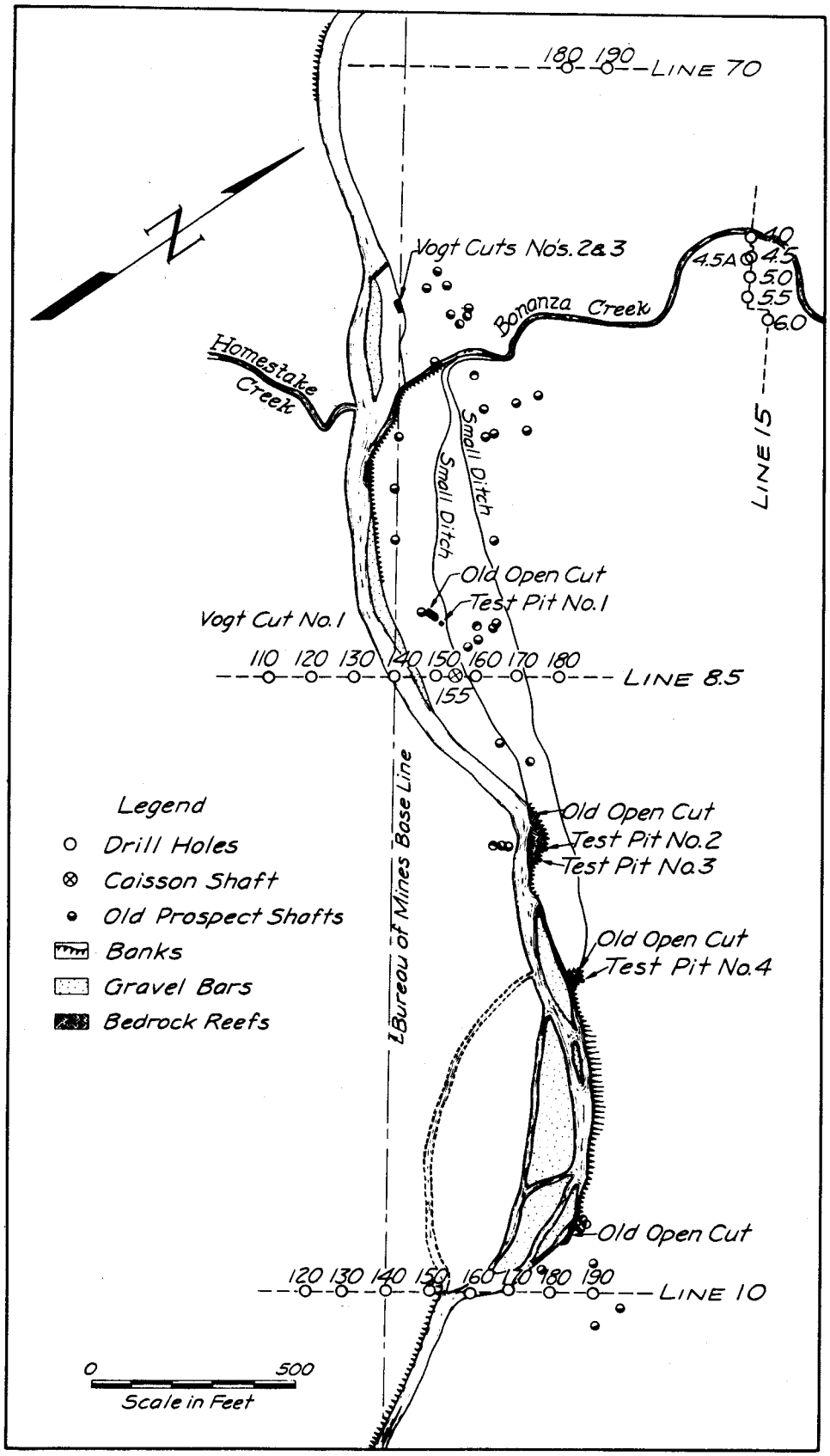

Figure 3. - Morelock Creek showing location of Prospect shafts and drill holes.

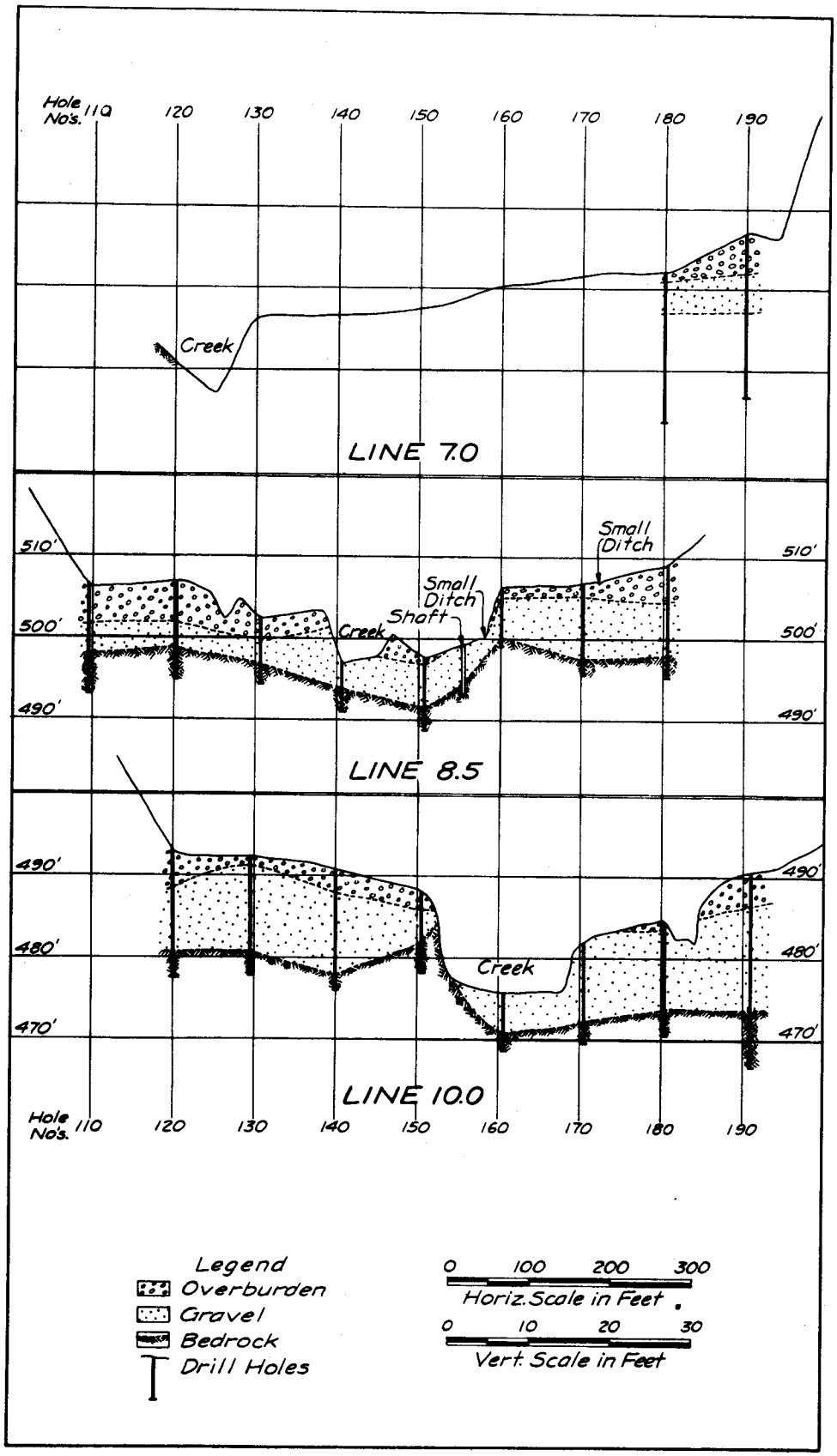

Figure 4. - Sections through drill holes, Morelock Creek.

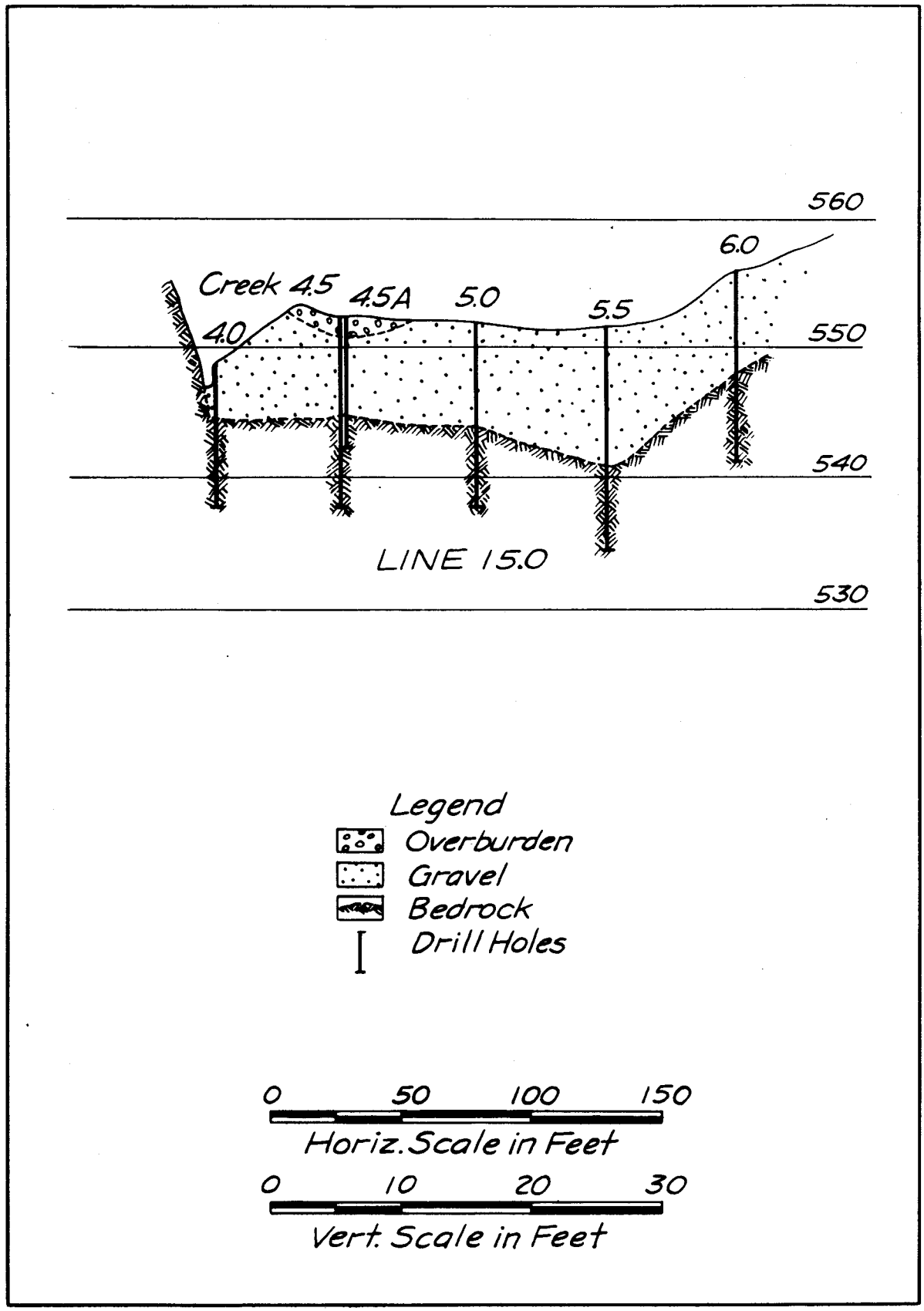

Figure 5. - Section through drill holes, Bonanza Creek.

The character of materials drilled and depth of each change in material were recorded. When practical, 2-foot samples were taken in barren overburden and upper gravels, and 1-foot samples were collected in the tin and gold horizons. Each sample was deslimed, measured loose in a volume bucket, and panned. Concentrates from the panning of each sample were put in separate jars, labeled as to depth, number of hole, and line, and brought to a central point at the close of each shift.

Each individual sample was then panned, the gold extracted by amalgamation and weighed, and the concentrates tested for the presence of tin by the zinc method, examined with a hand lens, and weighed. The individual samples from one hole were then combined and labeled to form one sample of tin concentrates and one sample of gold.

All holes were drilled into bedrock for at least 2 feet, and some were drilled deeper, depending on the amount of heavy mineral concentrate found.

Open holes were drilled in the frozen ground. The procedure of sampling and recording the formations was that used in thawed ground, except that after completing the hole a volumetric water measurement was made to determine the size of the hole in the mineral-bearing horizon.

Each deslimed sample was measured to the nearest thousandth of a cubic foot. The percentage of solids in the mineral-bearing horizon was determined by using the sum of the total measured volumes loose and the volume of the hole as determined by the water measurement.

The first holes drilled were on line 10. These crosscut the valley floor and passed through the upper section of a reported tin-bearing area and approximately 700 feet downstream from another similar area. The results of analyses of the concentrates in the eight holes that comprised this crosscut revealed only a trace of tin and no gold. Apparently the tin-bearing streak did not continue downstream to this point. With the establishment of a lower limit of tin and gold-bearing gravels, drill line 8.5, 1,500 feet upstream from line 10, was drilled to crosscut the valley floor. Eight holes were drilled on this line at 100-foot intervals.

In calculating the amount of tin present, 75 percent of the pan concentrate from each hole was estimated to be tin concentrate. The tin concentrate was assumed to be 57 percent tin. By this method, a factor of 0.427 was determined for tin calculations. Applying this factor, the average weighted content of tin in line 8.5 was 0.12 pound a cubic yard, or 0.27 pound over a square yard of bedrock. The weighted value of gold was 0.0037 ounce a cubic yard, or 0.0085 ounce over a square yard of bedrock. This line crosscut a supposedly high-grade area.

Two holes were put down on line 7. No tin or gold was found to be present.

Five holes were drilled at 50-foot intervals on line 15 on Bonanza Creek, crosscutting the full width of the valley floor. The average weighted content of tin in this line, assuming the concentrates to be 57 percent tin, was 0.0443 pound a cubic yard, or 0.1492 pound over a square yard of bedrock, and the gold content was 0.0097 ounce a cubic yard, or 0.0328 ounce over a square yard of bedrock.

Table 1 is a summary of drilling results.

Test Pitting

Four small test pits 2 to 4 feet in depth were put down on Morelock Creek. These were located on the high "reefs" and in virgin ground near old workings. The material excavated was carefully panned, and the bedrock area was measured to determine the amount of material extracted.

Pit 1 is above line 8.5, and pits 2 and 3 were put down on a high reef of bedrock below line 8.5. Pit 4 is in an old cut 700 feet above line 10. The location of the pits is shown on figure 3.

The indicated tin and gold content in the vicinity of the pits, measured as total content over each square yard of bedrock, is as follows:

Pit	Pounds of tin over each square yard of bedrock	Ounces of gold over each square yard of bedrock
1	0.0008	0.0026
2	0.0393	0.0022
3	0.0153	0.0051
4	0.0603	0.359

These pits verify the results obtained from the drilling and discount the existence of a large and continuous tin-bearing area.

TABLE 1. - Summary of drilling results

Line	Hole No.	Total	Depth - feet: Overburden	Depth - feet: Gravel	Depth - feet: Mining section*	Analysis Cu. Yd.: Lbs. Sn	Analysis Cu. Yd.: Oz. Au	Depth of Mining Section x Lbs. of Sn a cu. yd.	Depth of Mining Section x Oz. of Au a cu. yd.
Morelock Creek									
10.0	120	15.0	3.5	8.0	0.0	0.0	0.0		
	130	15.0	1.5	10.5	.0	.0	.0		
	140	15.0	3.0	9.0	.0	.0	.0		
	150	10.0	2.0	4.0	.0	.0	.0		
	160	7.0		5.0	.0	.0	.0		
	170	13.0		10.0	.0	.0	.0		
	180	14.5	1.0	10.0	.0	.0	.0		
	190	24.0	4.0	13.0	.0	.0	.0		
8.5	110	13.0	4.5	4.5	6.5	.0562	.0	0.3653	0.0000
	120	12.0	5.0	3.0	5.0	.0300	.0	.1500	.0000
	130	8.0	2.5	3.0	5.0	.0556	.0037	.2780	.0185
	140	6.5	.5	3.0	5.0	.4562	.0	2.2810	.0000
	150	9.0	1.0	5.0	7.0	.1618	.0202	1.1326	.1414
	160	9.0	1.0	5.0	7.0	.0362	.0051	.2534	.0357
	170	12.0	1.5	7.5	10.5	.1706	.0010	1.7913	.0105
	180	14.0	4.5	6.5	8.5	.0518	Trace	.04403	.0000
Total					54.5			6.6919	0.2061
Average						0.1227	0.00378		
7.0	180	18.0	1.0	4.5		.0	.0		
	190	20.0	5.0	5.0	6.0	.0341	.0		
Bonanza Creek									
15.0	4.0	11.0	0.0	5.0	9.0	0.0045	0.0	0.0405	0.0000
	4.5	10.0	2.0	5.5	7.5	.1250	.0127	.9375	.0952
	4.5A	14.5	.0	8.0	14.0**	.0675	.0082		
	5.0	14.0	.0	8.0	10.0	.0687	.0099	.6870	.0990
	5.5	17.0	.0	11.0	14.0	.0093	.0143	.1302	.2002
	5.5	Hole abandoned because of boulders encountered.							
	6.0	14.6	0.0	8.0	0.0	0.0	0.0		
Total					40.5			1.7952	0.3944
Average						0.0443	0.00973		

*The mining section includes at least 2 feet of bedrock. No overburden is included in the mining section.

**Not included in sum.

Caisson Shaft Sinking

One "caisson" shaft, numbered 155 on line 8.5, was sunk to bedrock to verify the drilling. In this work, 1/8-inch steel caissons were used. A 3-1/2-inch gasoline-operated pump was used for unwatering the shaft. A small sluice box was set up near the hole, and the gravels extracted were sluiced over pole riffles, using the water pumped from the hole. This method proved to be the fastest and simplest means of handling the samples.

Considerable water was found in the shaft, which salted the material extracted with fines that were washed in below the caisson. All materials removed were run through the sluice box. The sluice was cleaned after the upper 3 feet of gravel was washed to determine whether any concentrates were present. The last 3 feet of materials were sluiced separately, and the boxes were again cleaned to determine the content of the bedrock concentration of tin minerals and gold.

Assuming the concentrates to contain 57 percent tin, the results indicate a gravel content of 0.0531 pound of tin a cubic yard, or 0.1089 pound over a square yard of bedrock, and the gold content to be 0.0055 ounce a cubic yard, or 0.113 ounce over a square yard of bedrock.

Despite the anticipated salting, the recovered amount of gold and tin concentrate did not vary materially from the results of the drilling.

Open-Cut Mining

During the period in which the drilling operations were in progress Vogt mined three small open cuts. At the completion of each cut, the area of the cleaned bedrock was measured by a representative of the Bureau of Mines, who was also present during the clean-up. The tin concentrate was turned over to the Bureau of Mines, and the gold was weighed and recorded in the presence of the representative.

Cut 1, on a narrow, high reef of bedrock, produced 6.8 cubic yards of material, from which 3.94 pounds of tin concentrate and 0.31 ounce of gold were recovered. The average tin content was 0.329 pound a cubic yard and the gold 0.0455 ounce a cubic yard.

Cuts 2 and 3 are on high bedrock near the mouth of Bonanza Creek. In cut 2, 32.9 cubic yards of material were handled, from which 0.563 pound of tin concentrate and 0.6410 ounce of gold were recovered. The average tin content was 0.0097 pound a cubic yard, and the gold 0.0195 ounce a cubic yard. In cut 3, from which 1.452 pounds of tin concentrate and 1.0 ounce of gold were recovered, 31.6 cubic yards of material was mined. The average tin content was 0.0262 pound a cubic yard, and gold 0.0316 ounce a cubic yard.