Bureau of Mines
Report of Investigations 5373

TIN-BEARING PLACER DEPOSITS NEAR TOFTY, HOT SPRINGS DISTRICT, CENTRAL ALASKA

BY BRUCE I. THOMAS

United States Department of the Interior — December 1957

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UNITED STATES DEPARTMENT OF THE INTERIOR
Fred A. Seaton, Secretary
BUREAU OF MINES
Marling J. Ankeny, Director

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by

Bruce I. Thomas[1/]

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1/ Mine examination and exploration engineer, Bureau of Mines, Region I, Juneau, Alaska.

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SUMMARY

As a part of the United States Department of the Interior program for developing natural resources in Alaska, the Bureau of Mines studied the tin-bearing gold-placer deposits in the Tofty area of the Hot Springs district in central Alaska. The principal objective of the Bureau's work was to obtain facts about the extent and character of the placer deposits (including tailing) to indicate the economic or strategic tin-production potential of the Tofty "tin belt." A secondary objective was to determine (if possible) the bedrock source of the cassiterite and other minerals found in the placer deposits.

The placer phase of the work was begun in July 1954 and was continued during the 1955 and 1956 field seasons. Extensions to, and connections between, known placer channels were sought by 82 churn-drill holes. The Bureau drilling did not expand the placer deposits beyond the limits established by drift-mining operations and by previous drilling done by private concerns.

Extensive prospect-drilling data submitted by private operators were compiled by the Bureau's engineer and are included with this report by special permission of the owners. These data designate the holes in which cassiterite was noted (in relative amounts only) and infer a strategic reserve of tin within the drilled areas; additional unmined reserves in other parts of the Tofty area may be inferred on the basis of geologic evidence and the results of former mining operations.

Eleven tailing piles, representative of former drift mining along the principal placer channels, were trenched by tractor dozer, and the sides of the trenches were systematically channel-sampled; average tin content of the sampled piles ranged from a trace to as much as 6.9 pounds per cubic yard. Inferred reserves of all drift-mine and open-pit tailing throughout the length of the tin belt are estimated to be 1,259,000 cubic yards containing 733,000 pounds of tin; the tailing also may contain as much as 17,700 ounces of gold.

In addition to gold and cassiterite, spectrographic and petrographic studies of concentrates from the placer deposits established the presence of small amounts of ilmenite, rutile, chromite, magnetite, scheelite, zircon, monazite, columbite, eschynite, and ellsworthite.

INTRODUCTION

The association of tin minerals with gold in the extensive placer deposits near the abandoned mining town of Tofty in the Hot Springs district of central Alaska (fig. 1) has long been known, and some cassiterite has been recovered as a "nuisance" byproduct of gold mining. Few systematic attempts to save the cassiterite were made, and much of the tin was wasted. Mining records are scarce and incomplete.

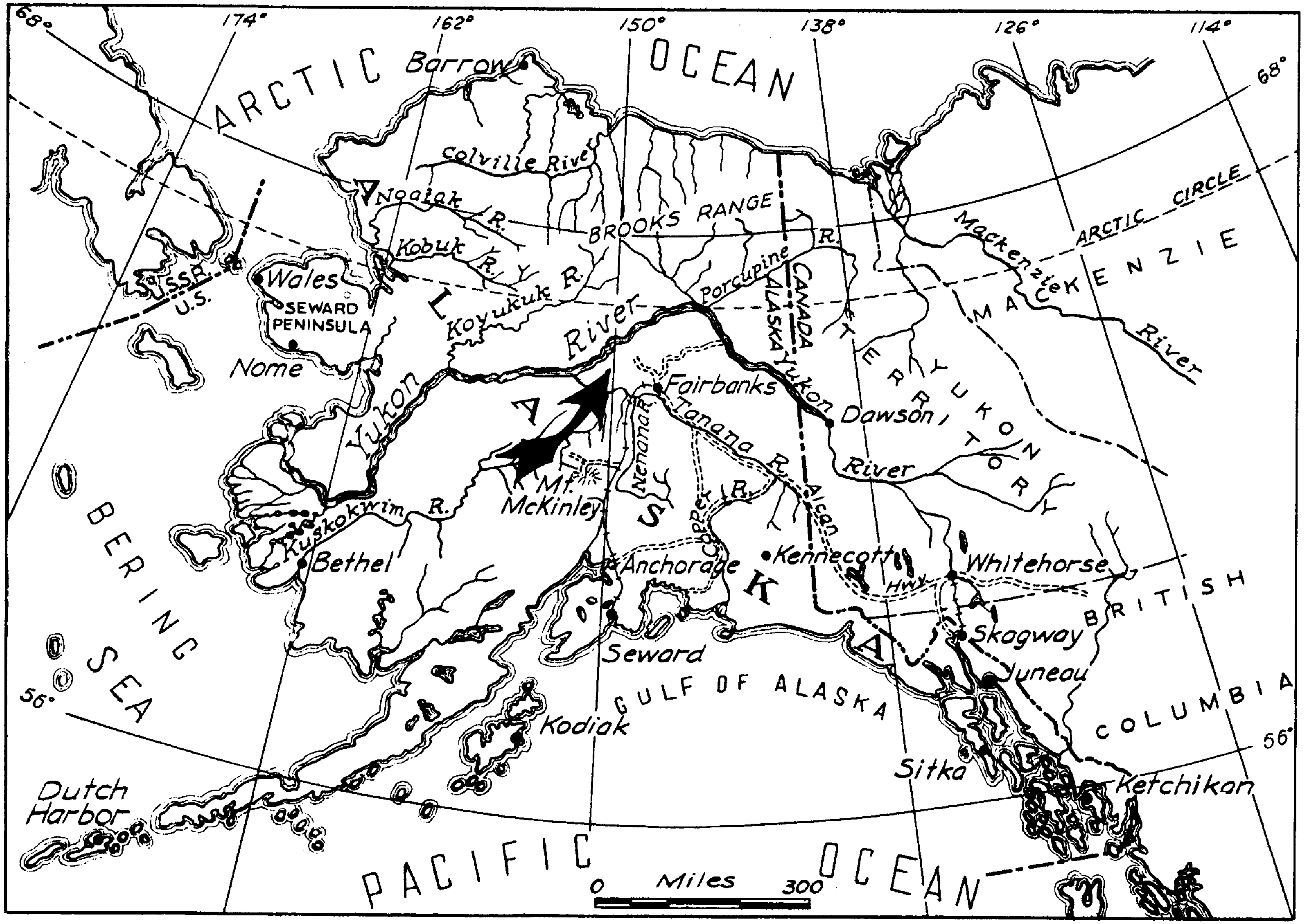

Figure 1. - Index map of Alaska. (Arrow points to Tofty tin area.)

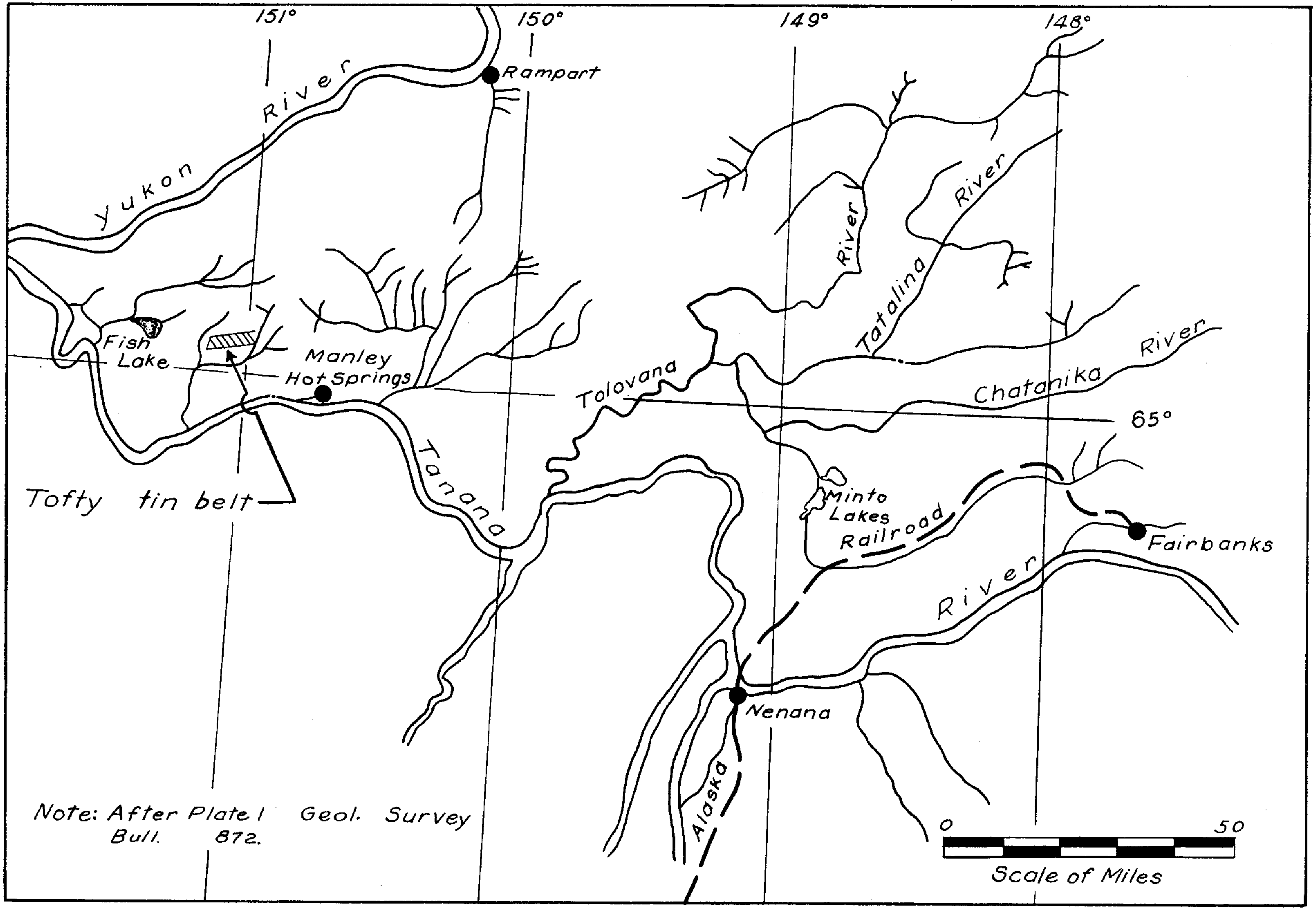

Figure 2. - Index map, Tofty tin belt, Alaska.

Because wartime demands for tin focused much attention on the Tofty tin belt, the Bureau of Mines began systematic sampling of tailing in the area during the early spring of 1943. The work was discontinued after the dumps from one large opencut on Sullivan Creek[2/] had been sampled. The results of the work were inconclusive but indicated that the numerous tailing dumps and potentially large, unworked gold placers in the Tofty area may contain an important strategic reserve of tin that could be recovered in an emergency or, with proper equipment and favorable markets, as a byproduct valuable enough to stimulate additional mining and exploration. The character of the placer deposits and other geologic evidence strongly suggested a local or nearby bedrock source of the cassiterite and other placer minerals.

As a part of the Interior Department's continuing program for developing Alaska natural resources, particularly strategic mineral deposits, the Bureau of Mines resumed its work in the Tofty area in July 1954 and continued it during the 1955 and 1956 field seasons. The principal purpose of the work was to indicate the tin-production potential of the placer deposits, but attention also was given to determining the lode sources of the placer minerals. The lode phase of the investigation is still in progress and will be described later. This report presents data resulting from the placer phase of the Tofty investigation; it includes information obtained from work by the Bureau of Mines and pertinent data contributed by private operators.

ACKNOWLEDGMENTS

The Alaska Road Commission gave unstinted cooperation in providing much needed repairs to the access roads and lending camp equipment for use by the Bureau crew.

Special acknowledgment is extended to Harold Strandberg of Strandberg Mines, Inc., for making available many valuable drilling data and to Tom Dean for the use of camp facilities and for drill-hole sampling records.

Appreciation is expressed to Clyde Larson and A. W. Pringle for the use of equipment and parts; such use prevented much lost time and was of great assistance in promoting the efficiency of the mechanical phases of the investigation. Lloyd Hubbard and Frank Jones gave valuable help and extended many courtesies to members of the Bureau of Mines crew.

LOCATION AND ACCESSIBILITY

The Tofty tin belt (named after the abandoned mining town of Tofty) is about 32 miles east of the confluence of the Yukon and Tanana Rivers at longitude 151°00' W., and latitude 65°05' N. (figs. 1 and 2). The nearest settlement is Manley Hot Springs, which has a population of about 25 in winter and about 50 in summer. It has a small general store, where bulk quantities of fuel oil and gasoline can be purchased, a roadhouse, a post office, a commissioner and recording office, a weather and radio station, and a small, commercial airfield. Small truck gardens supply the local demands for in-season vegetables and fruits. A good truck road about 20 miles long connects Tofty with Manley Hot Springs; an adequate telephone system also connects both localities. During the summer freight is brought in from the coast by railroad to Nenana, where it is transferred to river boats that deliver

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2/ Thorne, R. L., and Wright, W. S., Sampling Methods and Results at the Sullivan Creek Tin Placer Deposits, Manley Hot Springs, Tofty, Alaska: Bureau of Mines Rept. of Investigations 4346, 1948, 8 pp.

it to Manley Hot Springs landing; from there it is hauled to Tofty by truck. Freight rates differ widely according to commodity but are generally high by Stateside standards. Most travel is by airplane in summer as well as in winter. A small airfield near Miller Gulch serves the immediate area.

Fairbanks, the largest town in central Alaska and the principal source of supplies and labor, is approximately 90 miles east of Tofty. Regular air-mail and passenger service is maintained between Fairbanks and Manley Hot Springs; flights direct to Tofty may be made by special arrangement. Light freight, as well as fresh meats and produce, is usually transported from Fairbanks by plane. Heavy freight is shipped from Fairbanks by river boat direct to Manley Hot Springs or by railroad to Nenana, thence by river boat to Manley Hot Springs landing.

A highway now being constructed will connect the local road network at Manley Hot Springs with Livengood, about 70 miles northeast. When this highway is completed, the Tofty area will be connected to the main interior Alaska highway system; thereafter, landed-freight costs should be substantially decreased.

PHYSICAL FEATURES AND CLIMATE

The Tofty tin belt is near the western extremity of the Yukon-Tanana upland; it consists of low, rounded ridges that rise from the broad valley floor of Patterson Creek. Patterson Creek and its tributaries flow in valleys that are much larger than would be required for their normal streamflow. Two prominent landmarks, Roughtop Mountain (altitude 3,179 feet) and Hot Springs Dome (altitude 2,682 feet) flank the placer area to the northeast and southeast, respectively.

The climate is typical of the subarctic region of central Alaska; winters are long and cold, and summers are short and relatively warm. The alluvial deposits are permanently frozen, except along the courses of some streams and in some areas that have been drift-mined. In summer the ground thaws to a depth of only a few feet; this relatively thin mantle of thawed ground usually freezes down to the permafrost level during the winter. The penetration of seasonal frost, over permanently thawed areas, is controlled to a great extent by the depth of snow in winter. The snow provides a layer of protective insulation, which restricts the depth to which the ground freezes. A thick layer of moss, which blankets much of the area, also provides effective insulation against the seasonal freezing and restricts the depth of seasonal thawing. Natural (solar) thawing can be accelerated during the summer by removing the moss and by periodic removal of thawed muck.

The annual precipitation (12 to 13 inches) is comparable with that in other areas in central Alaska. Snow covers the region from mid-October until early May; its depth ranges from 3 to 4 feet on the level. The spring runoff is rapid, because the frozen ground prevents normal absorption or underground circulation of the surface water. In summer the moss retards drainage; consequently, much of the precipitation is held on or near the surface. The broad valley floors and gentle slopes a are marked with numerous small lakes, potholes, and large areas of swampland or "muskeg," which make overland travel during the summer season difficult - particularly for heavy equipment.

Dwarf spruce is distributed widely over the region; sparse growths are found high on hill slopes and along valley courses. Occasional patches of spruce trees 2 feet or more in diameter grow along Patterson Creek near the lower end of the valley. Thick growths of birch and poplar are on unfrozen ground along the southward-facing hill slopes. An occasional birch or poplar grows among the thickets of willow and alder that line the stream courses.

Except in thickly timbered areas, on some southward facing slopes or in the occasional grassy meadows, the ground is covered with moss, brush, and creeping plants. Timber for mining purposes and for fuel is obtained from lower Patterson Creek to the southwest and from the headwater tributaries of Baker Creek to the northeast. Large areas have been cut over to supply wood fuel for the steam boilers used in the mining operations.

HISTORY AND PRODUCTION

The original discovery of gold in the placers was made on Tofty Gulch in the winter of 1906-07. Considerable prospecting with churn drills and shafts and a large amount of underground drift mining, as well as some opencut mining, have been done in the area during the past 50 years; much of this work was done within a few years after the stampede that followed the original discovery of gold. No permanent records were made of the early prospecting results or of early drift-mining accomplishments. The first systematic churn-drill sampling of which there is a permanent record was done in the early 1930's to block out opencut reserves, but only sketchy mention of tin or other heavy-mineral content was incorporated in the recorded drill-hole data. A permanent record was also made of churn-drill hole sampling done a few years later. Some of these data have been made available to the Bureau of Mines for limited use in preparing reports covering the area.

Cassiterite was a plentiful byproduct of the early operations but because of the generally unprofitable market was seldom saved; nevertheless, some clean concentrate was sold to local merchants at prices as low as 5 cents per pound delivered to boat landings. Wagon or pack-animal freight from the mines to points of delivery consumed a considerable proportion of the sales price. In 1929 a shipment of Tofty concentrate assaying 57.9 percent tin is reported to have been sold for 123 pounds sterling in Singapore; net proceeds to the shipper at Tofty were about $400.00 a ton. Most recorded tin production from the area occurred after 1929. No special equipment or methods were employed to recover the cassiterite; the production resulted from such heavy-mineral concentrates as could be recovered conveniently in the conventional sluicebox used in gold-placer washing methods.

Numerous piles of drift-mine tailing along upper Cache Creek, Idaho Gulch, Miller Gulch, Deep Creek, and Woodchopper Creek mark the positions of old shafts and roughly outline the course of the pay channels followed during the early period of intense underground activity. Relatively little drift mining has been done in recent years; but occasionally a working shaft is sunk during the winter by 2 or 3 men working as partners. The volume of material mined by these partnerships usually is small; the value of the gold recovered rarely exceeds wages or a small grubstake for each partner. Inefficient wood-fired boilers were, and still are, used to furnish steam for hoists and pumps and for thawing equipment. Because of the small size, poor quality, and sparse distribution of the native timber, fuel cost for the wood-burning boilers is exceptionally high.

During the winter of 1953-54 a working shaft was sunk on Deep Creek by two partners. Mining operations were conducted from this shaft during the winter of 1954-55. The operation was visited by the writer and is described on pages 48 and 55 of this report. According to reports, Strandberg Mines, Inc., plans to reopen the pits at Tofty Gulch and Sullivan Creek and to develop other mineral-bearing areas along the tin belt.

The total recorded mineral recovery from placers in the Tofty tin belt, as compiled from old and recent records, is tabulated by pay channel or location as follows:

TABLE 1. - Mineral production from Tofty placers through 1956

Place	Gold, ounces	Silver, ounces	Cassiterite concentrate, pounds
Sullivan Creek	58,136	5,463	215,445
Miller Gulch	17,576	2,668	101,875
Deep Creek	6,864	653	56,200
Woodchopper Creek	28,501	3,402	40,300
Patterson Creek	2,599	385	20,282
Tofty Gulch	8,855	1,376	19,600
Hokeley Gulch	820		8,000
Cache Creek	3,650	409	5,155
Dalton Gulch	466		3,000
Idaho Gulch	61		300
Total	127,528	14,356	470,157

According to reports, the average tin content of the cassiterite was 60 percent. On this basis the recorded tin recovery from the Tofty area is approximately 280,600 pounds or 125.3 long tons of metal.

PROPERTY AND OWNERSHIP

Pay channels along the tin belt are covered by both patented and unpatented mining claims.

Mining claims on Sullivan Creek, Tofty Gulch, and Idaho Gulch are owned by L. V. and Helen McGee of Reno, Nev.; these claims currently are leased to Strandberg Mines, Inc., of Anchorage, Alaska. Claims in Miller Gulch are held by the Tom Dean estate and the George Millianich estate of Manley Hot Springs, Alaska. The A. Bock estate holds mining claims on both Woodchopper and Deep Creeks; these claims now are leased to Strandberg Mines, Inc. Henry Besonen of Fairbanks, Alaska, has claims on Deep Creek, and the George Rolke estate holds mining claims on Woodchopper Creek. Fred Hansen and associates, of Fairbanks, Alaska, hold a group of claims on Deep Creek. Claims on Cache Creek are owned by Gus A. Benson and associates, of Manley Hot Springs, Alaska.

The records of unpatented mining claims are on file at the recording office at Manley Hot Springs; records of patented mining claims are on file at the office of the Bureau of Land Management, Anchorage, Alaska.

WATER SUPPLY

During most of the summer enough water flows in Sullivan Creek to supply the demands of open-pit operations at Sullivan Creek and at Tofty Gulch. During dry periods it is practical to recirculate water from settling ponds. Gravel dumps accumulated from winter drift mining usually are sluiced in the spring, while runoff water is abundant in the numerous small ponds and streams.

If opencut mining develops to the extent that the present water supply becomes inadequate, small dams could be built to impound water from the upper drainage basins of Sullivan and Woodchopper Creeks.

DESCRIPTION OF DEPOSIT

General Geology

The geology of the Tofty area and that of the gold-tin placer deposits have been described in detail by Eakin,[3] Mertie,[4] Waters,[5] and others. The following brief discussion is based on a summary of the geological information contained in the various publications and on field observations by Bureau of Mines engineers.

The Tofty placers are along the north side of the valley of Patterson and Sullivan Creeks, which occupies a broad, alluvial-filled depression between Roughtop Mountain and Hot Springs Dome. Both mountains are prominent uplifts composed of granitic rocks believed to be of Tertiary age. The area, known as the "tin belt" because cassiterite is a prominent constituent of the placers, extends from Woodchopper Creek on the southwest to Killarney Creek, a headwater tributary of Baker Creek on the northeast. The belt includes parts or all of the valleys of Woodchopper Creek, Deep Creek, Miller Gulch, Idaho Gulch, Tofty Gulch, Sullivan Creek, and Cache Creek, with its upper tributaries Harter Gulch, Dalton Gulch, and Ferguson Gulch; all these creeks are tributaries to Patterson Creek or to its principal branches (fig. 3). The tin belt, about 12 miles long, trends S. 70° W.; the long axis of the belt roughly parallels the dominant structure of the country rock.

Nearly all of the placer workings are along the gulches that drain the hills on the north side of the Patterson Creek-Sullivan Creek Valley, or more commonly the ground lying along the sides of such gulches; consequently each group of workings trends normal to the tin belt (fig. 3). Individual pay streaks cut off rather abruptly as they were followed northward or upstream; however, although the northerly economic limits of the deposits were rather sharply defined, additional prospecting has indicated that rapidly diminishing but appreciable amounts of gold and tin extend considerable distances beyond the formerly accepted line of sharp cutoff. Where the gulches merge southerly into the main valley, the gold and tin content decreases gradually - probably because of dispersion; furthermore, the greater depth to bedrock in the main valley imposes limitations on mining.

The country rock of the tin belt, where exposed on the surface and in mine workings, is sheared and contorted phyllite, schist, quartzite, graywacke, and slate, in which lenses and stringers of quartz are numerous and pyrite is abundant. These rocks are believed to be of Cretaceous age; where observed in underground workings and in cuttings from churn-drill holes, they have been subjected to intense and deep-seated weathering. Quartz veins and stringers that contain trace amounts of tin have been found in and adjacent to the placer area, and some lodes that contain small amounts of gold and silver have been found near the granite of Hot Springs Dome; however, very little lode prospecting has been done along the tin belt because rock outcrops are scarce and the deep frozen overburden makes exploration by trenching slow and expensive.

Granitic intrusives and associated dikes are exposed on Roughtop Mountain about 6 miles north of the placer deposits and on Hot Springs Dome, which at its

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3/ Eakin, Henry, M., A. Geologic Reconnaissance of a Part of the Rampart Quadrangle, Alaska: Geol. Survey Bull. 535, 1913, pp. 35-38.

4/ Mertie, J. B., Jr., Mineral Deposits of the Rampart and Hot Springs District Alaska: Geol. Survey Bull. 844-D, 1934, pp. 163-224.

5/ Waters, A. E., Jr., Placer Concentrates of the Rampart and Hot Springs Districts: Geol. Survey Bull. 844-D, 1934, pp. 224-246.

nearest point is 5 miles south of the tin belt. Although cassiterite has not been found in the intrusives or their associated dikes, trace amounts of tin have been identified in concentrate panned from the headwaters of streams directly draining the granitic exposures. A study of the intrusive rocks by Waters[6] indicates that the granite of Hot Springs dome is similar in chemical composition and quantitative classification to the granites with which most of the major tin deposits of the world are associated. The Roughtop Mountain intrusive is classed as a monzonite which differs considerably from typical tin granites; therefore it is considered a less likely source of the tin minerals. Quartz-tourmaline rocks, similar to those found near Ohio Creek, which cuts the granite 3 miles southeast of Hot Springs dome, are found as cobblestones in the drift tailings on Woodchopper Creek and Deep Creek. Thus far the dominant evidence points to the granite of Hot Springs dome, or a related but unexposed intrusive, as the most likely source of the tin minerals found in the placer deposits.

Physical Characteristics and Mineralization

The gravel in most creeks along the tin belt is composed chiefly of subangular to poorly rounded pebbles and cobbles of phyllite and slate, but it also contains well-rounded fragments of quartzite, graywacke, and quartz. However, the gravels of lower Woodchopper and Deep Creeks near the western end of the tin belt are composed chiefly of quartz; these are known as "white gravels."

The shallower parts of the deposits contain 3 to 10 feet of gravel overlain by 10 to 20 feet of silt, commonly referred to as "muck"; the deeper parts of the deposits contain 5 to 45 feet of gravel overlain by 10 feet to 120 feet of muck. On lower Woodchopper Creek the depth to bedrock is reported to be over 200 feet. In most places the gravel and muck are permanently frozen.

In general, the gravel contains only a moderate amount of clay; consequently, it is easily mined when thawed. However, according to reports, the gravel in lower Woodchopper Creek contains considerable, tightly compacted clay, which makes it difficult to mine.

The frozen muck is essentially silt which contains veins and lenses of ice, frozen plant and animal fossil remains, and considerable sand and gravel, some of which is in thin layers and some of which is mixed with the silt. Sand and gravel in the muck do not interfere seriously with drift-mining operations but do add considerably to the expense of open-pit mining because, when the silt is removed by the usual hydraulic methods, the contained sand and gravel accumulate on underlying muck sections where they impede stripping progress; if not removed they dilute the underlying pay gravel.

The bedrock is principally weathered phyllite and black slate, with some quartzite and graywacke; in places the slate contains much pyrite. Gold, cassiterite, and associated heavy minerals usually are found in the lower 2 feet of the gravel and the upper 2 feet of bedrock. The surface of bedrock is irregular; in places it rises abruptly as much as 20 feet. On the slopes of the abrupt rises, muck rests directly on bedrock without intervening gravel. Little or no gold, cassiterite, or other heavy minerals are found where there is no gravel.

6/ Work cited in footnote 5, p. 8.

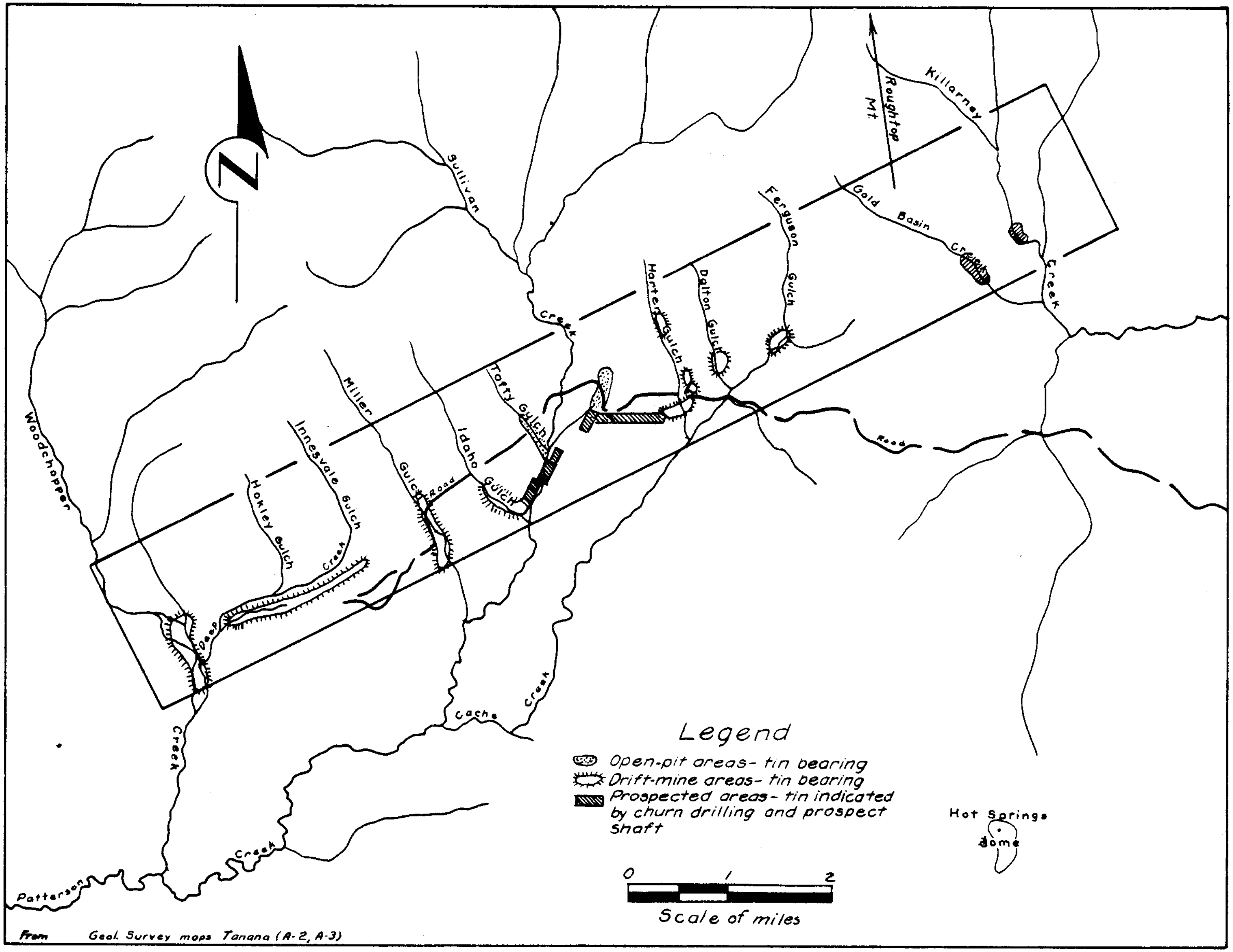

Figure 3. - Tofty tin belt, Alaska.

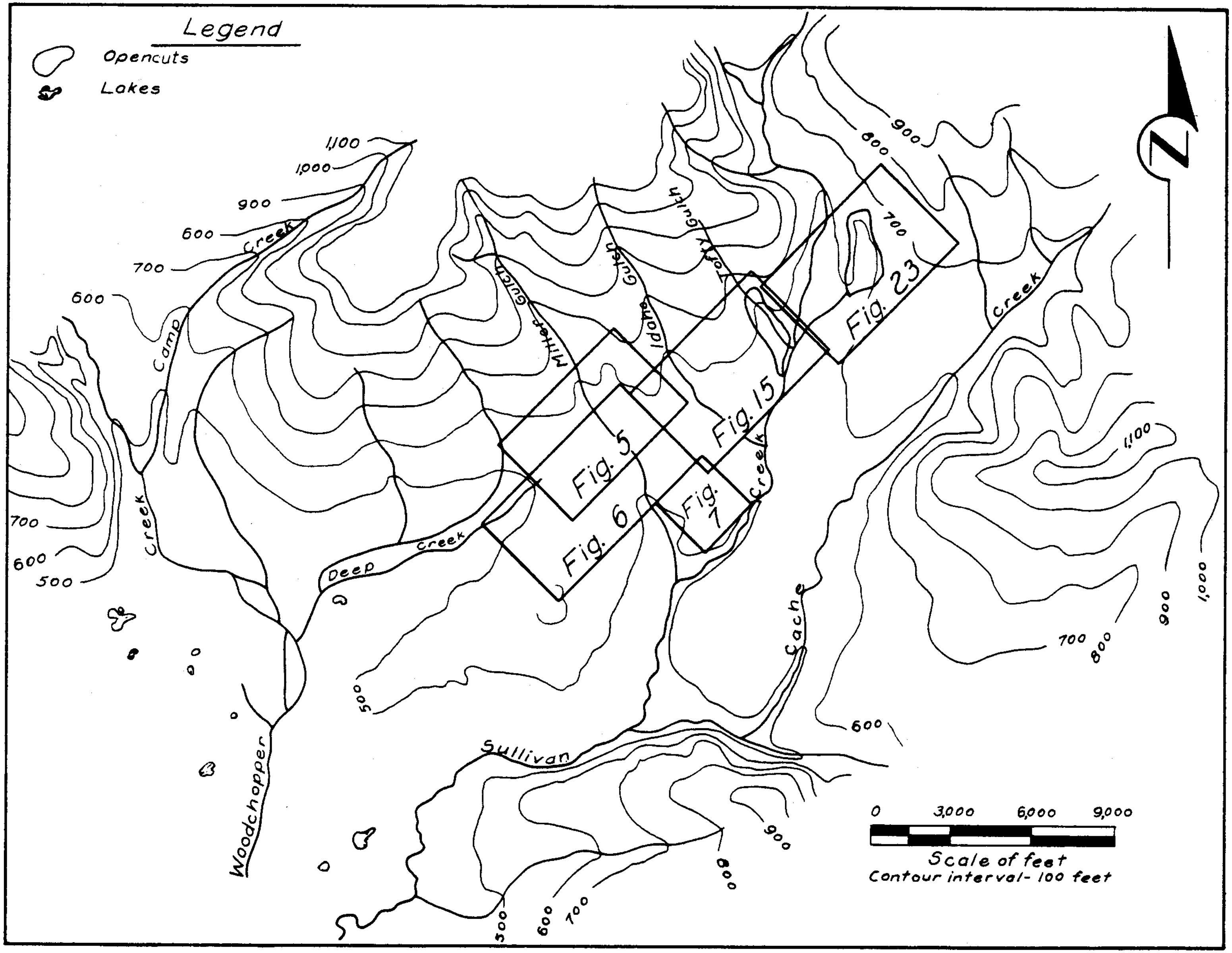

Figure 4. - Index of topographic maps, showing churn-drill-hole sites.

The gold and cassiterite in the placer deposits occur together or in proximity. A high concentration of gold usually indicates a similar concentration of cassiterite in the same area or in proximity but not necessarily together; tin enrichment containing little gold and vice versa has been noted in recent underground workings on Deep Creek. Areas of separate gold and tin enrichment are so small, however, that the minerals are recovered together in mining.

The cassiterite ore occurs as well-rounded to slightly subangular gravel ranging in size from microscopic particles to cobbles as much as 6 inches in diameter. The larger particles and cobbles contain vein quartz and numerous angular fragments of rock believed to be of sedimentary origin; the cassiterite, with associated tourmaline, fills fractures in the quartz and the spaces between the angular fragments of sedimentary rock. The smaller particles of cassiterite ore, minus-4-mesh and smaller, are fairly free from gangue minerals; they can easily be concentrated to a product assaying 60 percent or more tin. The larger particles and cobbles vary considerably in tin content (see table 7, p.43); they would have to be crushed to produce a high-grade concentrate.

BUREAU OF MINES WORK

Objectives and Procedures

The objectives of the Bureau of Mines work at Tofty were to indicate the tin and other heavy-mineral production potential of the placer deposits (including tailing), to determine if the tin mineralization extended beyond the limits established by early drift-mining operations, and to determine, if possible, the bedrock source of the placer minerals. Fieldwork consisted of churn drilling, sampling and surveying of drift-mine tailing piles, examination of active underground operations, topographic mapping, angledozer trenching, and accumulation and compilation of extensive drill-hole data resulting from exploration by former operators. Laboratory work included further concentration of field samples by tabling and analyses of the resulting concentrates by chemical, spectrographic, and petrographic processes.

Churn-Drill Sampling Methods and Results

Churn-drill sampling (fig. 4) was begun on Miller Gulch with line 11-1/2, about 2,500 feet upstream and north of the pay channel, as indicated by evidence of old underground workings. Successive lines were drilled downstream in accessible places until unfrozen, swampy ground made further drilling impractical in this area. Reconnaissance drilling was continued on higher ground along the northern margin of the placer deposits, into Idaho Gulch, and down the gentle slope normal to Sullivan Creek Valley, as well as across the head of Deep Creek. The sum of all drilling completed was 3,198 linear feet in 82 holes. The locations of drill lines are shown in figures 5, 6, and 7; the bedrock topography is shown in figures 8 and 9; placer sections through drill lines are shown in figures 10 through 14, inclusive. The extension of line 17 is shown in figure 15.

A portable-type, modified, 6-inch churn drill was used. Thin placer bits, forged to 5-5/8 inches, were used in open and cased holes. Heavy, special, 6-inch drive pipe with a 7-1/2-inch shoe was used when thawed ground was tested.

Bulk samples were reduced to a concentrate of heavy minerals by a hand-operated gold pan and rocker. Drill-hole logs show the character of materials drilled and the depth of each change in material. Muck overburden is barren; therefore it was discarded without being sampled. Gravel was sampled at intervals of 2 feet until panning revealed the presence of gold, cassiterite, or other heavy minerals; then the sampling interval was reduced to 1 foot. Holes were drilled into bedrock for at least 5 feet.

Each pumping was deslimed, measured loose in a special measuring bucket, and panned. Concentrate from each panning was examined in the field, then combined for a composite panning concentrate for each hole. Tailing from panning was put through a rocker, from which a sample identified as "rough concentrate from rocker" was recovered. Rocker tailing was pipe-sampled at each hole. Slime was tested in the field from time to time to determine if any heavy minerals were being carried away in the fines.

Panning concentrate, rough concentrate from rocker, and pipe samples of rocker tailing were shipped to the Bureau of Mines laboratory at Juneau, Alaska. At Juneau the rough concentrates from rocker and pipe samples of rocker tailing were concentrated further on a laboratory-size, Deister-type table to recover such heavy minerals as may have been lost in the field; however, little or no valuable heavy minerals were recovered by tabling. Gold particles were separated from heavy-mineral concentrates by visual methods to conform with standard placer-evaluation procedure; gold so obtained was weighed and recorded in milligrams.

Concentrate samples were assayed for tin and given preliminary examinations for other heavy-mineral content. Drilling and sampling results are summarized in tables 2 and 3. The small amounts of tin, gold, and other heavy minerals obtained from most of the drill holes did not justify quantitative estimates for each hole.

The Bureau drilling did not locate extension of known pay channels within the area investigated.

All cuttings from drilling in bedrock were examined carefully for evidence of lode mineralization; no valuable ore minerals were identified.

Basic churn-drill-hole data from 348 placer prospect holes drilled during former mining operations were made available to the Bureau by present operators and property owners for use in preparing placer sections and bedrock topographic maps. This information was compiled and, by permission of the owners, is included with Bureau of Mines data to indicate the depth of overburden, thickness of gravel section, and bedrock topography of the tin-placer deposits; gold values have been omitted, except where specifically permitted by the operator.

A summary of data obtained from early drilling on Miller Gulch, compiled from prospect logs furnished by Tom Dean, is given in table 4 (p. 23); no quantitative estimates of tin were entered on the original drill logs. Although much of the area drilled has been mined, these data are included with this report to indicate the characteristics of a typical "pay channel" on Miller Gulch. Sampling results from tailing piles A and B, summarized in tables 9 and 10, are roughly representative of the tin content of gravels mined from the area. Bedrock topography is shown in figure 8; placer sections through drill lines are shown in figures 11 and 13.

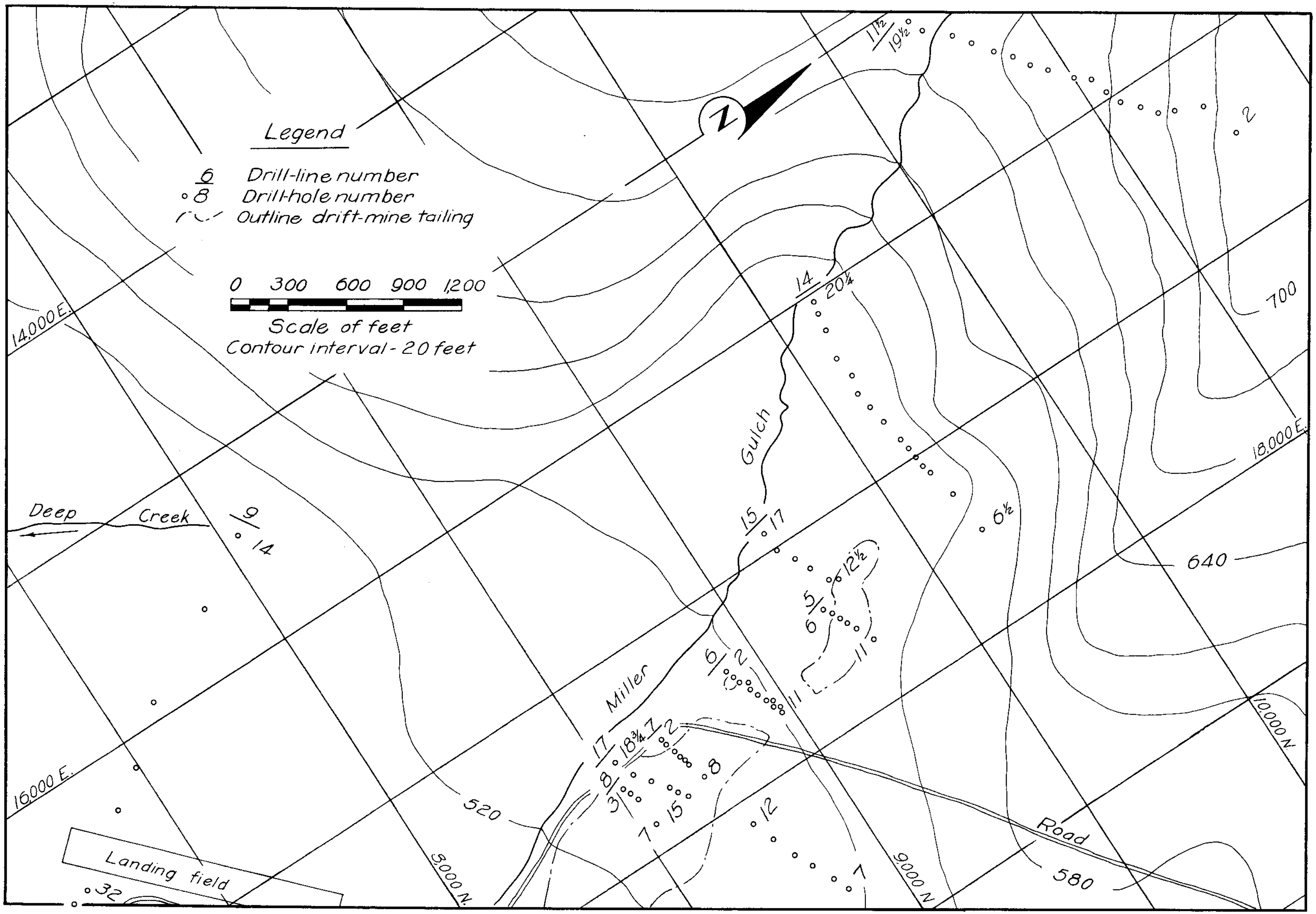

Figure 5. - Topographic map, with churn-drill-hole sites, Miller Gulch and Deep Creek.

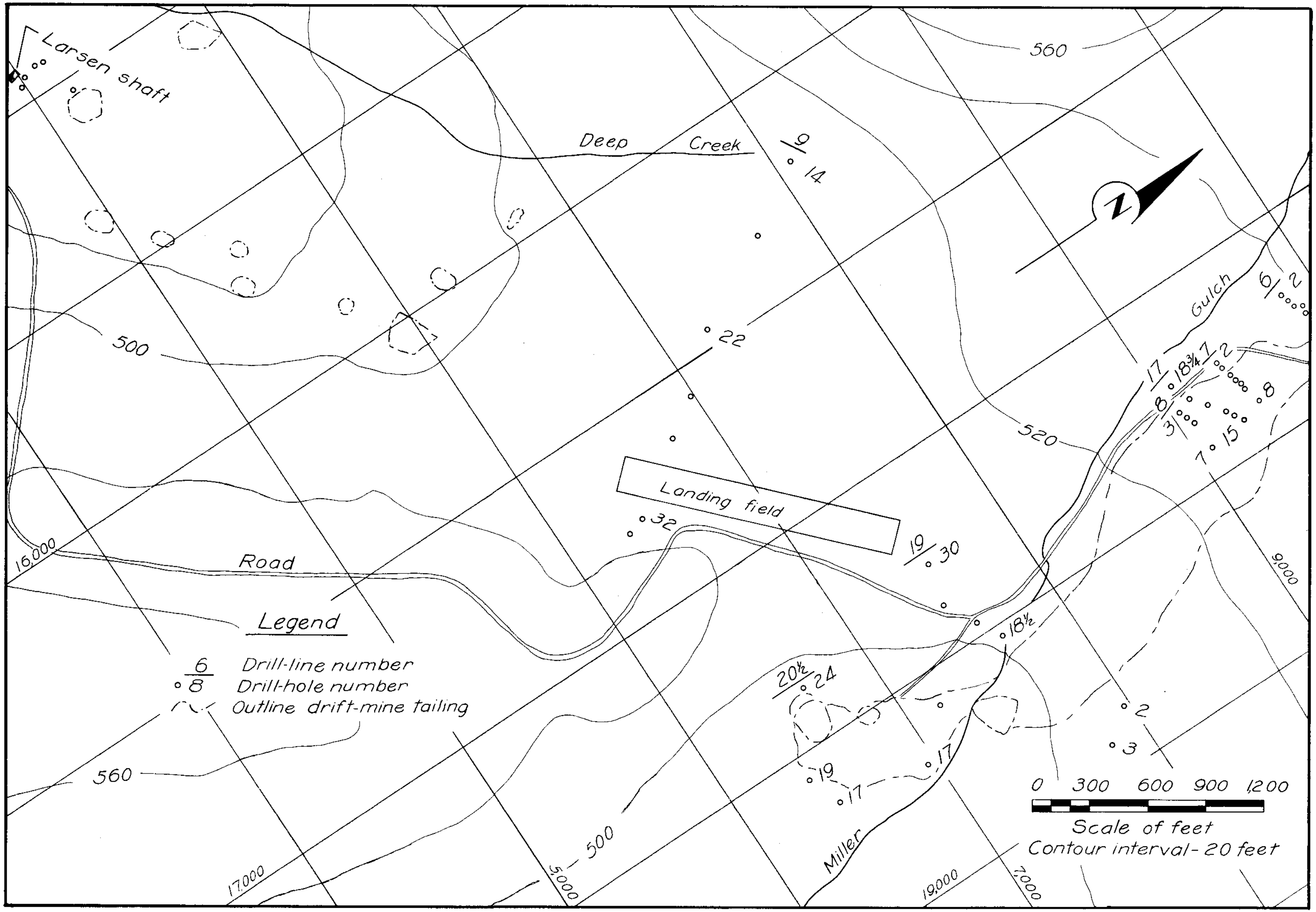

Figure 6. - Topographic map, with churn-drill-hole sites, Miller Gulch and Deep Creek.

TABLE 2. - Summary of drilling and sampling results, Miller Gulch and Deep Creek
6-inch holes, drilled open (without casing)

Line No.	Hole No.	Total depth, ft.	Depth O.B., ft.	Depth gravel, ft.	Depth bedrock ft.	Conc., gm.	Gold, mg.	Tin, percent	Value/cu. yd. Tin, lb.	Value/cu. yd. Gold, troy oz.	Ground condition	Surface elev., ft.
11-1/2	2	29.0	4.0	21.0	4.0	17.6	0	< 0.05	Tr.	Tr.	Fr.	711
	4	29.0	4.0	11.0	14.0	10.9	0	< .05	do.	do.	do.	698
	5	40.0	6.0	29.0	5.0	62.8	Tr.	.10	do.	do.	do.	684
	6	28.0	3.0	21.0	4.0	131.8	do.	.10	do.	do.	do.	677
	7	20.5	3.0	13.0	4.5	11.3	do.	.20	do.	do.	do.	672
	8	16.0	3.0	13.0	0	33.8	5.75	.10	do.	do.	do.	665
	9	12.0	1.0	11.0	0	9.9	Tr.	-	do.	do.	do.	661
	10	15.0	5.0	6.0	4.0	6.7	2.10	.20	do.	do.	do.	658
	11	6.0	3.0	Aband.	0	5.3	Tr.	-	-	-	Fr. & Th.	654
	12	8.0	7.5	do.	0	-	-	-	-	-	do.	653
	13	17.3	9.0	2.0	6.3	11.9	Tr.	.20	Tr.	Tr.	Fr.	648
	14	15.0	5.0	4.0	6.0	11.1	5.50	.10	do.	do.	do.	643
	15	17.4	3.0	11.0	3.4	14.1	Tr.	.10	do.	do.	do.	637
	16	14.5	3.0	6.0	5.5	15.3	do.	< .05	do.	do.	do.	631
	17	15.3	5.0	6.0	4.3	33.5	do.	< .05	do.	do.	do.	627
	18-1/2	19.5	7.0	5.0	7.5	48.9	do.	.05	do.	do.	do.	625
	19-1/2	18.0	7.0	8.0	3.0	6.6	do.	.05	do.	do.	do.	628
14	6-1/2	47.0	8.0	36.0	3.0	22.4	0	< .05	do.	0	Fr. & Th.	565
	8-1/2	40.9	9.0	31.9	0	20.6	Tr.	.10	do.	Tr.	Fr.	554
	10	23.5	8.0	9.0	6.5	47.02	1.0	< .05	do.	do.	do.	551
	10-1/2	24.5	4.0	11.0	9.5	45.74	6.41	< .05	do.	do.	do.	552
	11	22.0	4.0	14.0	4.0	28.88	0	.48	0.002	do.	do.	552
	11-1/2	22.0	2.0	11.0	9.0	76.88	57.0	1.12	.013	0.013	do.	551
	12	20.0	2.0	13.0	5.0	118.93	192.0	1.98	.020	.023	do.	550
	13	12.3	1.0	6.0	5.3	34.66	12.12	.66	Tr.	Tr.	do.	549
	14	15.4	3.0	4.0	8.4	27.50	3.84	.17	do.	do.	do.	550
	15	18.5	3.0	4.0	11.5	21.20	.98	< .05	0	0	do.	548
	16	15.0	5.0	2.0	8.0	12.00	0	< .05	0	0	do.	548
	17	16.4	6.0	1.0	9.4	30.30	0	< .05	0	0	do.	548
	18-1/2	22.0	5.0	2.0	15.0	30.60	7.14	< .05	0	Tr.	do.	549
	19-1/2	18.0	7.0	6.0	5.0	20.00	6.09	< .05	0	.Tr.	do.	553
	20-1/4	19.0	7.0	6.0	6.0	21.30	.0	.10	Tr.	0	do.	553
15	12-1/2	22.0	6.0	5.0	11.0	1.60	Tr.	Tr.	0	0	Th.	559
	13	12.0	7.0	2.0	3.0	7.60	do.	do.	0	0	Fr.	560
	14	17.25	7.0	5.0	5.25	18.60	0	do.	0	0	do.	560
	15	19.75	1.5	9.5	8.75	43.80	Tr.	do.	0	0	do.	555
	16	16.7	4.0	7.7	5.0	21.80	do.	do.	0	0	do.	554
	17	13.0	4.5	3.5	5.0	7.30	do.	do.	0	0	do.	555
17	4	6.0	6.0	0	0	0	0	0	0	0	Th.	
	7	27.0	11.0	11.0	5.0	90.7	0	< .05	0	0	Fr.	537
	8	27.0	8.0	14.0	5.0	83.6	0	.05	Tr.	0	do.	536
	9	31.0	10.0	14.0	7.0	19.0	0	1.1	do.	0	do.	534
	10	37.0	12.0	20.0	5.0	29.3	0	do.	0	0	do.	533
	11	43.0	10.0	28.0	5.0	20.4	2.0	.2	Tr.	Tr.	do.	534
	12	48.0	12.0	30.0	6.0	39.5	3.0	.6	do.	do.	do.	534
	15	40.0	7.9	32.2	0	103.9	12.0	Tr.	0	do.	Fr. & Th.	527
	15-1/2	16.0	12.0	4.0	0	41.9	0	0	0	0	do.	526
	16	12.0	12.0	0	0	30.6	5.0	Tr.	0	Tr.	do.	526
	16-3/4	22.0	6.9	15.2	0	20.6	1.0	0	0	do.	do.	525
	17-3/4	18.0	8.0	10.0	0	19.0	Tr.	0	0	0	Th. & Fr.	527
	18-3/4	50.0	9.0	36.0	5.0	26.5	2.0	Tr.	0	Tr.	Fr.	527
19	18-1/2	20.0	20.0	0	0	-	-	-			Th.	505
	20	82.0	35.0	43.0	4.0	3.2	59.0	34.3	Tr.	0.006	Fr.	507
	22	79.0	34.0	40.0	5.0	22.9	1.0	Tr.	0	Tr.	do.	506
10-1/2	30	79.2	29.0	42.0	8.2	74.4	0	< 0.05	Tr.	0	Fr.	507
	2	59.0	42.0	10.0	7.0	50.1	Tr.	Tr.	0	0	do.	507
	3	56.0	42.0	8.0	6.0	25.9	0	do.	0	0	do.	505
20	17	95.9	45.0	42.0	8.9	101.7	2.0	< .05	0	Tr.	do.	497
	24	105.0	36.0	64.0	5.0	55.1	0	Tr.	0	0	do.	499
20-1/2	17	110.0	45.0	60.0	5.0	44.1	18.0	2.7	Tr.	Tr.	do.	493
	19	115.0	44.0	66.0	5.0	97.1	Tr.	Tr.	0	0	do.	493
9	14	34.0	18.5	5.0	10.0	-	0	-	-	0	do.	504
	18	42.0	15.0	14.0	13.0	-	0	-	-	0	do.	505
	22	72.0	30.0	31.0	11.0	23.7	0	0.10	Tr.	0	do.	515
	26	98.0	43.0	48.0	7.0	19.1	0	.05	0	0	do.	513
	28	101.0	51.0	38.0	12.0	7.2	0	.05	0	0	do.	513
17	6	48.0	5.0	36.0	7.0	108.5	26.0	2.3	Tr.	Tr.	do.	555
	10	54.0	10.0	39.0	5.0	130.4	1.4	.14	do.	do.	do.	555
	14	55.0	10.0	41.0	4.0	28.3	Tr.	< .05	0	0	do.	555
	15	56.0	8.0	43.0	5.0	32.1	0	.10	0	Tr.	do.	557
	16	21.0	8.0	8.0	5.0	41.3	0	< .05	0	0	do.	556
	17	25.0	7.0	13.0	5.0	97.6	0	< .05	0	0	do.	555
	18	8.0	7.0	1.0	0						Fr. & Th.	554
	19	21.0	5.0	9.0	7.0	30.4	0	< .05	0	0	Fr.	555
	20	23.0	10.0	8.0	5.0	53.4	Tr.	< .05	0	0	do.	554

Fr. = Frozen.
Th. = Thawed.
Tr. = Trace.
< = Less than.

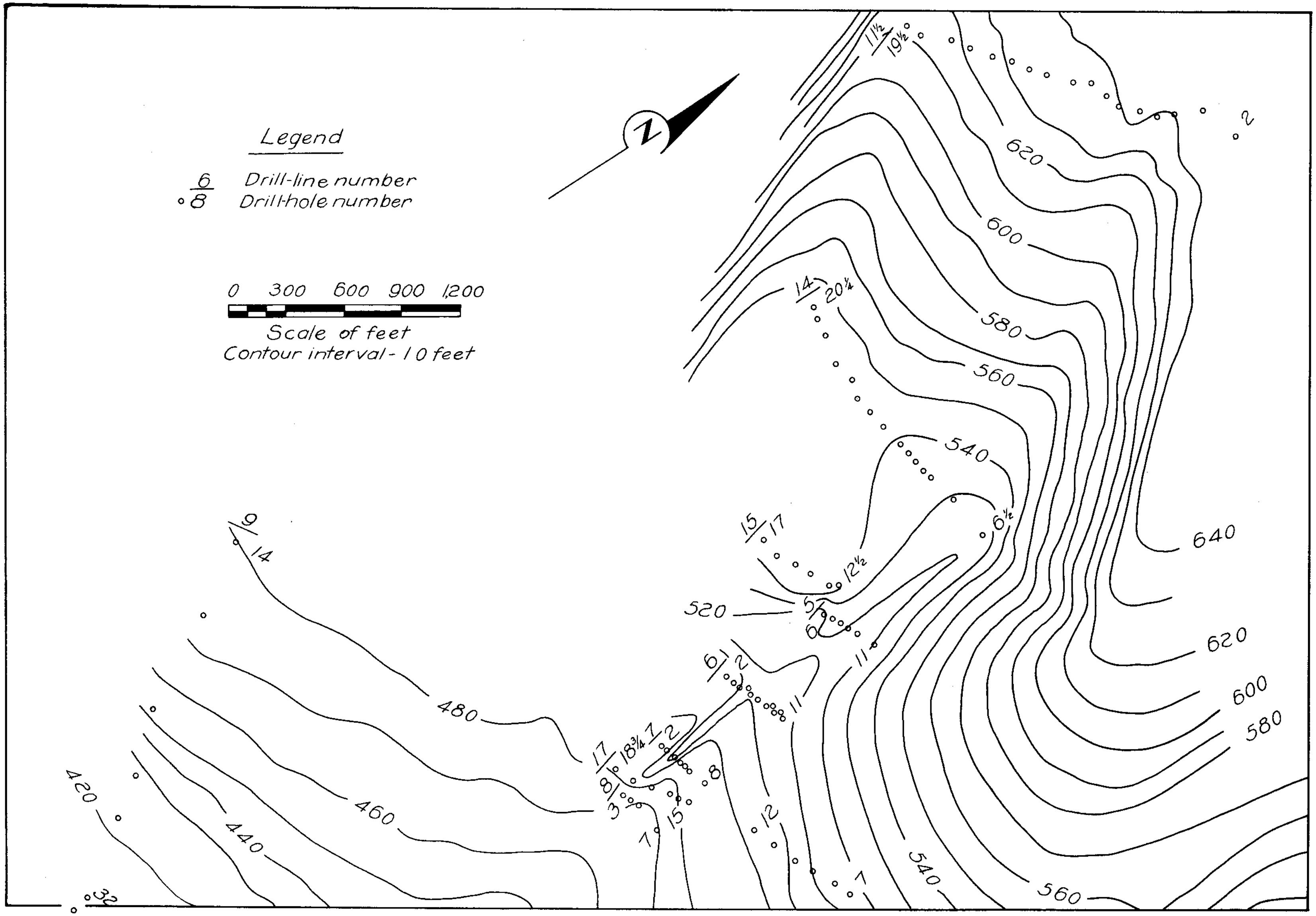

Figure 8. - Bedrock topographic map, with churn-drill-hole sites, Miller Gulch and Deep Creek.

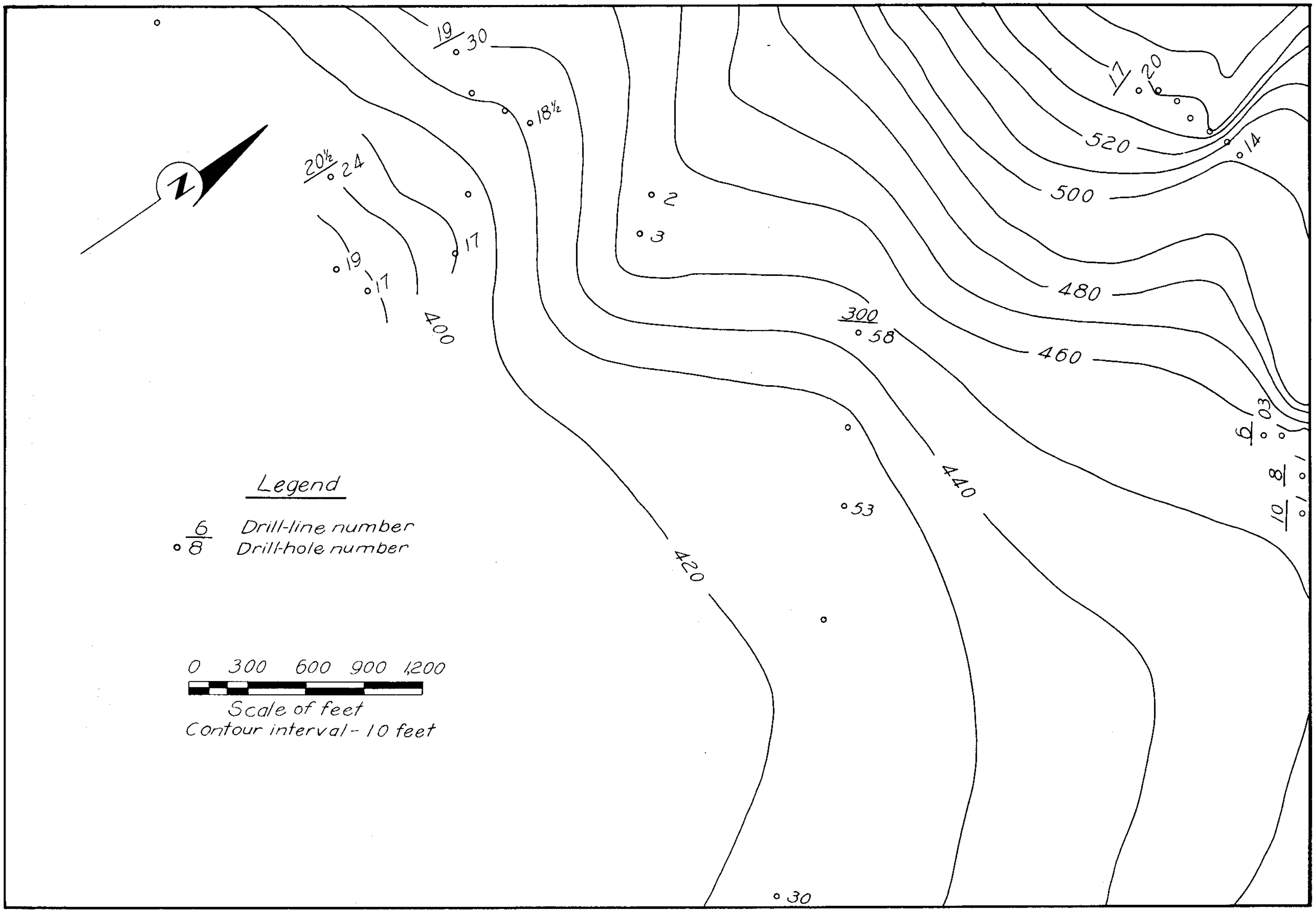

Figure 9. - Bedrock topographic map, with churn-drill-hole sites, lower Miller Gulch.

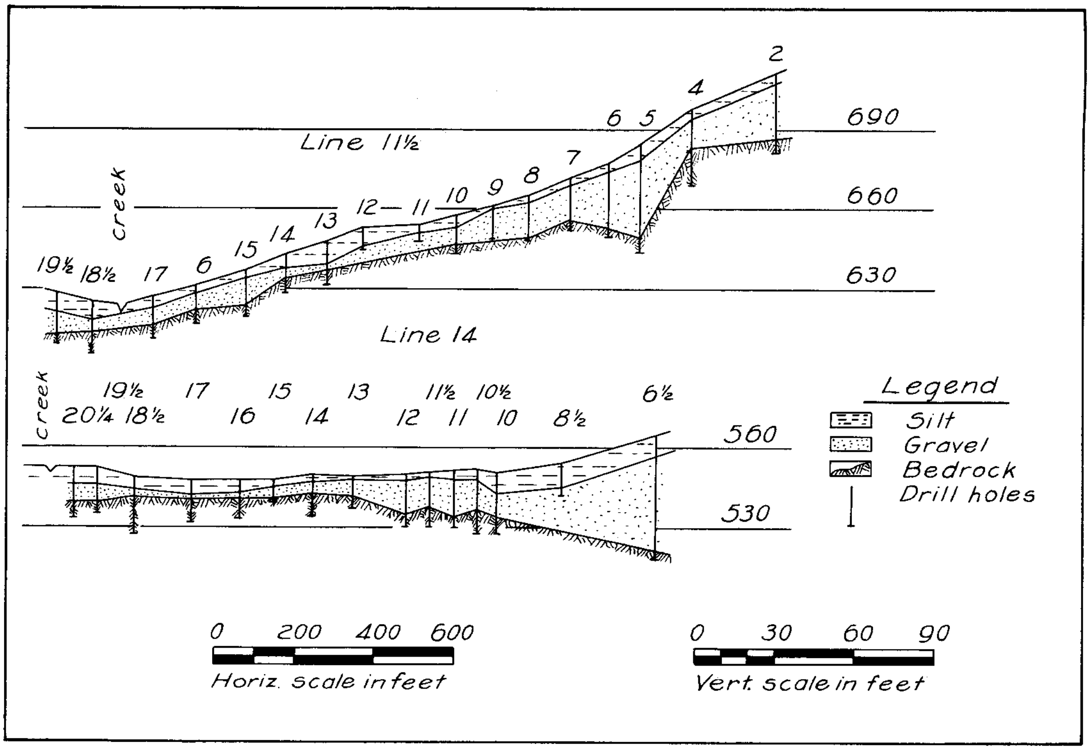

Figure 10. - Placer sections, drill lines 11½ and 6½.

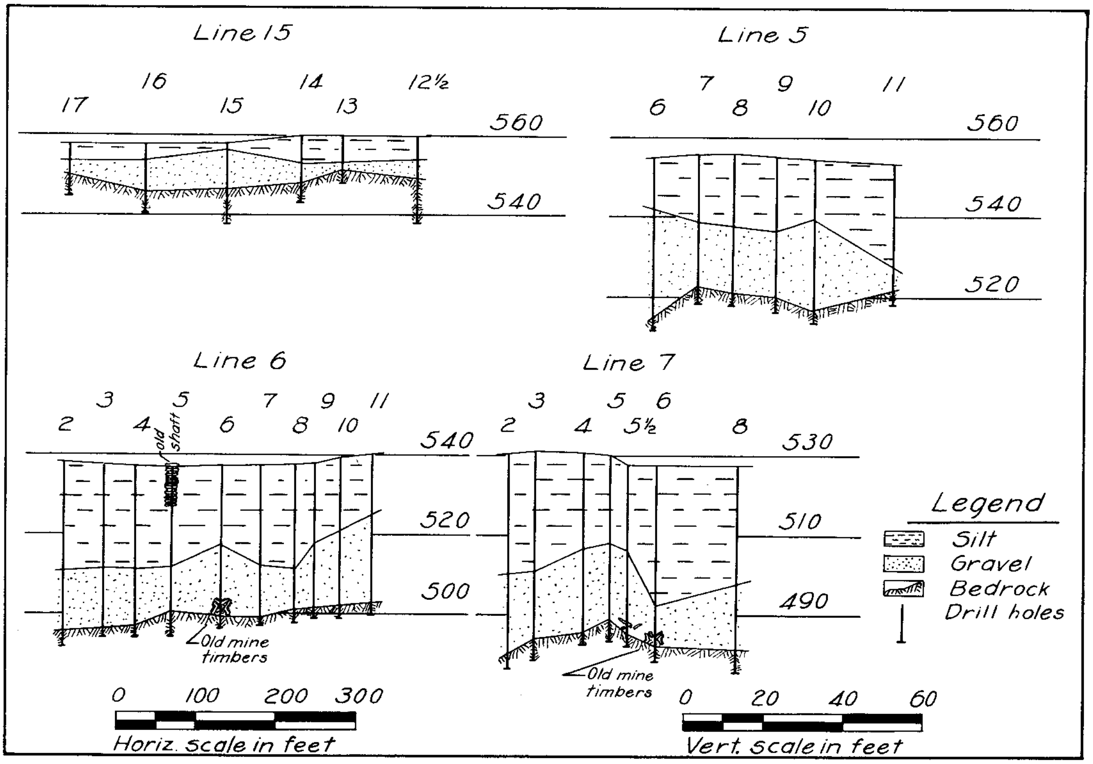

Figure 11. - Placer sections, drill lines 15, 5, 6, and 7.

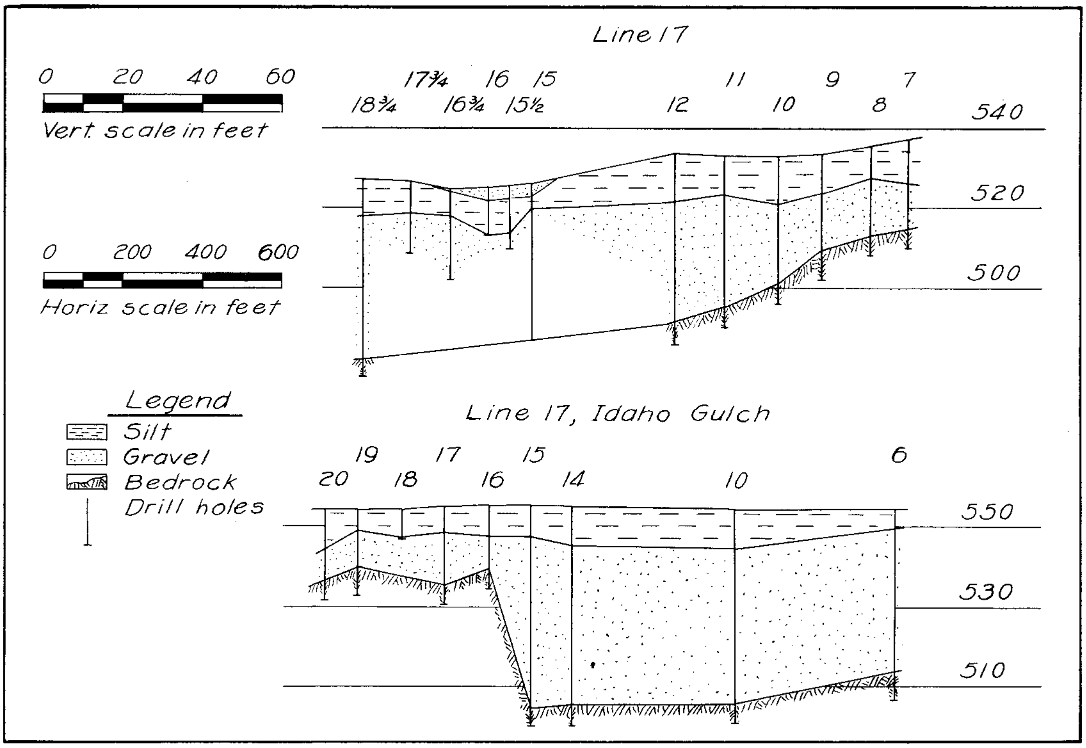

Figure 12. - Placer sections, drill line 17, Miller and Idaho Gulches.

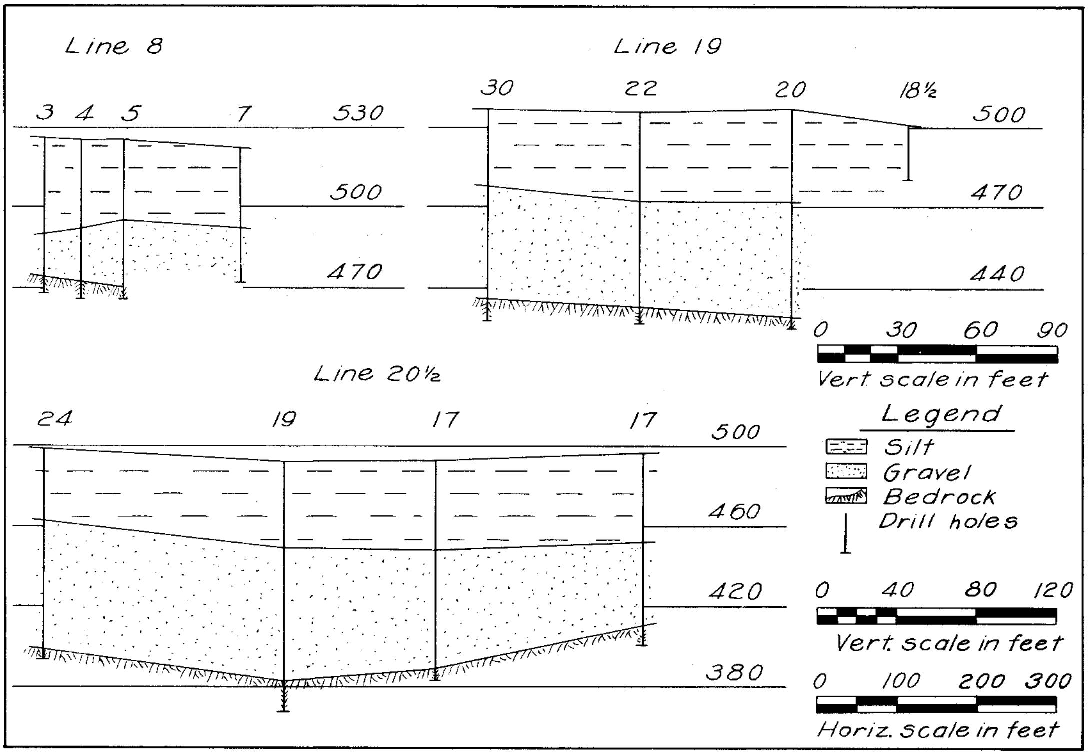

Figure 13. - Placer sections, drill lines 8, 19, and 20½.

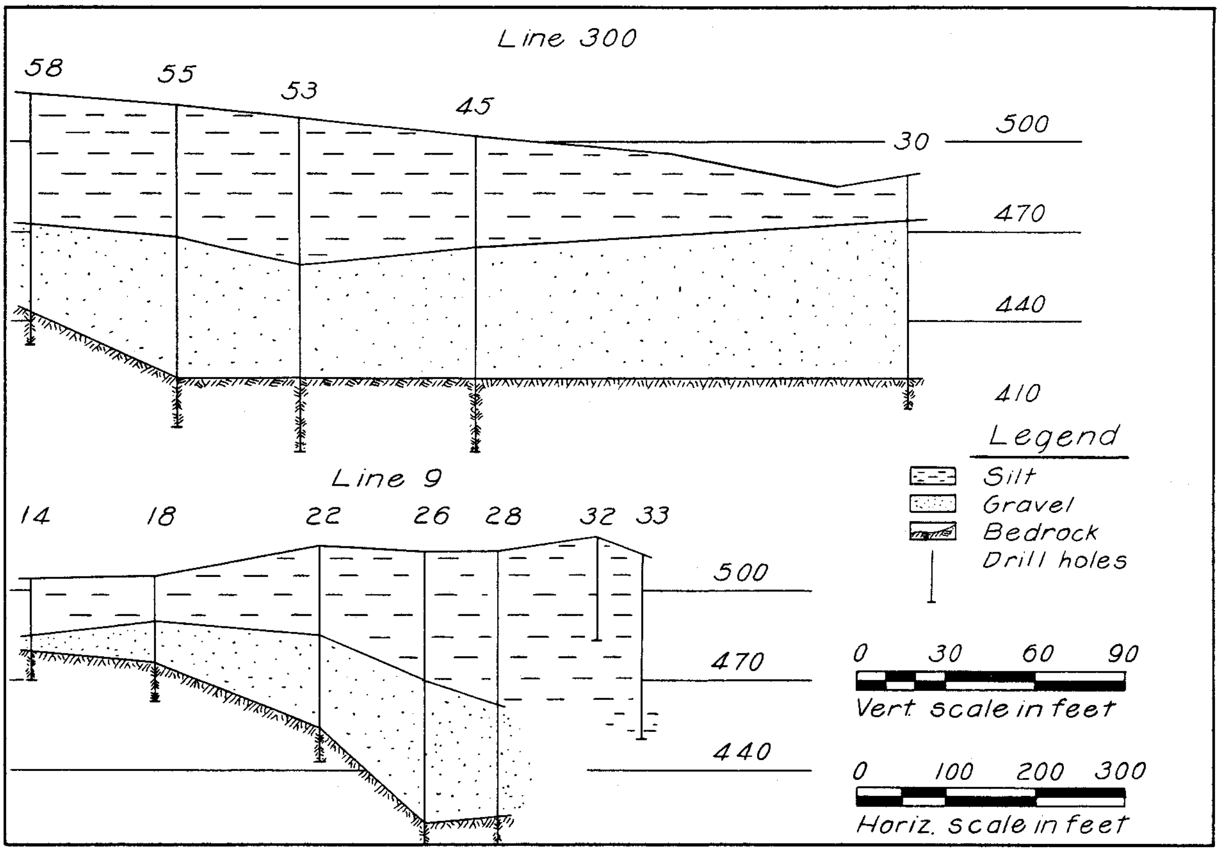

Figure 14. - Placer sections, drill lines 300 and 9.

TABLE 3. - Summary of drilling and sampling results, Sullivan Creek

Line No.	Hole No.	Total depth, ft.	Depth O.B., ft.	Depth gravel, ft.	Depth bed-rock, ft.	Conc., gm.	Gold, mg.	Tin, per-cent	Value/cu. yd. Tin, lb.	Value/cu. yd. Gold, troy oz.	Ground condi-tion	Surface elev., ft.
300	30	78.5	15.0	53.0	10.5	213.83	11.44	0.20	Tr.	Tr.	Fr.	489
	45	106.5	37.0	44.0	25.5	606.8	Tr.	.06	do.	do.	do.	502
	53	112.2	49.0	38.0	25.2	848.1	56.16	.20	do.	1/0.0004	do.	508
	55	108.3	44.0	42.0	22.3	486.0	33.00	.19	do.	Tr.	do.	512
	58	83.5	43.0	30.0	10.5	80.72	Tr.	.05	do.	0	do.	516

Fr. = Frozen.
Th. = Thawed.
Tr. = Trace.
1/ Mining section, 45 ft.

Drill-hole data from prospecting on Tofty and Idaho Gulches and on Sullivan Creek were made available by Harold Strandberg of Strandberg Mines, Inc. These data are summarized in tables 5 and 6, respectively; no values are given, but relative amounts of tin are shown. The locations of drill lines and holes, bedrock topography, and placer sections on Tofty and Idaho Gulches are shown in figures 15-23, inclusive; similar graphic data for Sullivan Creek are shown in figures 24-32.

TABLE 4. - Summary drill-hole prospect data, Miller Gulch 5-inch holes drilled open (without casing)

Data published with permission of owner:

Line No.	Hole No.	Total depth, ft.	Depth O.B., ft.	Depth gravel, ft.	Depth bedrock, ft.	Gold, mg.	Tin, percent	Value/cu. yd. Tin, lb.	Value/cu. yd. Gold, troy oz.	Ground condition	Surface elev., ft.
5	4-1/2	40.0	19.0	19.0	2.0	Tr.			0		
	6	43.0	13.0	27.0	3.0	28.0			0.004	Fr.	555
	7	37.0	17.0	16.0	4.0	Tr.				do.	556
	8	38.0	18.0	17.0	3.0	57.0			.015	do.	556
	9	39.0	19.0	16.0	4.0	Tr.				do.	555
	10	41.0	15.0	23.0	3.0	32.0			.009	do.	554
	11	35.0	26.0	6.0	3.0	Tr.				do.	553
6	2	46.0	27.0	15.0	4.0	10.0			Tr.	do.	539
	3	43.0	26.0	15.0	2.0	7.0			do.	do.	539
	4	43.0	26.0	14.0	3.0	27.0			do.	do.	539
	5	42.0	25.0	11.0	6.0	185.0			.085	do.	539
	6	41.0	20.0	18.0	3.0	20.0			.007	Fr. & Th.	538
	7	40.0	25.0	13.0	2.0	100.0			.049	Fr.	538
	8	40.0	26.0	10.0	4.0	35.0			.021	do.	538
	9	39.0	20.0	16.0	3.0	43.0			.014	do.	538
	10	40.0	15.0	22.0	3.0	30.0			.008	do.	540
	11	37.0	18.0	16.0	3.0	0				do.	540
7	2	54.0	30.0	20.0	4.0	27.0			.005	do.	531
	3	53.0	30.0	17.0	6.0	58.0			.018	do.	531
	4	48.0	24.0	21.0	3.0	112.0			.034	do.	531
	5	47.0	22.0	19.0	6.0	Tr.			Tr.	Fr. & Th.	530
	5-1/2	45.0	21.0	21.0	3.0	57.0			.012	do.	528
	6	49.0	35.0	10.0	4.0	Tr.			Tr.	Fr.	528
	8	52.0	30.0	16.0	6.0	15.0			.005	do.	
8	3	58.0	36.0	16.0	6.0	15.0			.006	do.	526
	4	59.0	33.0	20.0	6.0	205.0			.060	do.	525
	5	59.0	30.0	25.0	4.0	18.0			.004	do.	525
	7	50.0	30.0	20.0	0	Tr.			Tr.	Fr. & Th.	522

Fr. = Frozen.
Th. = Thawed.

TABLE 5. - Summary drill-hole prospect data, Tofty and Idaho Gulches

Published with permission of owner:

Line No.	Hole No.	Depth O.B., ft.	Depth gravel, ft.	Tin, present	Ground condition	Surface elev., ft.	Top gravel elev., ft.	Top bedrock elev., ft.
J	8	6.5	13.5	No	Fr.	530	523	509.5
	9	7	14	No	do.	531	524	510
	10	9	9	Yes	do.	531	522	513
	11	6	22	No	do.	531	525	503
	13	10	16	No	do.	530	520	504
	14	8	12	No	do.	530	522	510
	15	9	12	No	do.	530	521	509
	16	8	16	No	do.	532	522	506
	17	13	16	No	do.	534	521	505
	18	10	14	No	do.	535	525	511
	19	10	14	No	do.	539	529	515
	20	16	6	No	do.	543	527	521
K	11-1/2	7	16	Yes	do.	526	519	503
	14	9	19	Yes	do.	527	516	497
	15	10	18	No	do.	524	514	496
	16	10	18	No	do.	522	512	494
	17	8	20	No	do.	524	516	496
	18	11	17	No	do.	523	512	495
CR	C27	20	6		do.	532	512	506
	R28	23	9		do.	530	507	498
	R27	32	2		do.	528	496	494
	R26	28	5		do.	526	498	493
R	R29	30	13		do.	525	495	482
	R30	27	16		do.	523	496	480
	R31	38	3.5		do.	528	490	486.5
M	0	14	34	No	do.	550	536	502
	2	17	29	No	do.	543	526	497
	4	18	4	No	do.	537	519	515
	6	20	16	No	do.	529	509	493
	8	29.5	18.5	Yes	do.	525	495.5	477
	9	28	16	Yes	do.	521	493	477
	10	26.5	20.5	Yes	do.	518	491	471
	11	25	20	No	do.	516	491	471
	12	18	27	No	do.	514	496	469
	13	19.5	26.6	Yes	do.	512	492.5	466
	15	10	30	Yes	do.	507	497	467
	16	10	16	Yes	do.	504	494	-
N	8	30	25	Tr.	Fr.	531	501	476
	10	26	28	Tr.	do.	525	499	471
	12	20	35	Yes	do.	523	503	468
	14	21	2	No	Fr. & Th.	521	500	
	16	14.5	31.5	Yes	Fr.	514	499.5	468
	18	4	37	No	do.	505	501	464
O	06	22	14	No	do.			
	04	19	24	No	do.	560	541	517
	02	15	30	No	do.	554	539	509
	0	14	34	No	do.	550	536	502

Fr. = Frozen. Th. = Thawed.

TABLE 5. - Summary drill-hole prospect data, Tofty and Idaho Gulches (Con.)

Published with permission of owner:

Line No.	Hole No.	Depth O.B., ft.	Depth gravel, ft.	Tin, present	Ground condition	Surface elev., ft.	Top gravel elev., ft.	Top bedrock elev., ft.
0	2	19	34	No	Fr.	545	526	492
(Con.)	4	27.5	18.5	No	do.	542	515	496
	6	19	25	No	do.	539	520	495
	8	30	29	Yes	do.	537	507	478
	10	30	30	Yes	do.	532	502	472
	12	22	34	No.	do.	525	503	469
	14	25	27	No.	do.	522	497	469
	16	24	27	No.	do.	519	495	468
	18	12	37	No.	do.	512	500	463
1-A	1	8	39	No	do.	563	555	516
	2	7	37	No	do.	565	559	521
	3	8	35	Yes	do.	566	559	523
	4	12	33	Yes	do.	567	555	522
	5	10	36	Yes	do.	568	558	522
	6	10	33	No	do.	568	558	525
	7	20	20	No	do.	569	549	529
07	6	10	45	No	do.	560	550	505
	7	10	38	Yes	do.	560	550	512
	8	8	32	Yes	do.	561	553	521
03	10	8	28	No	do.	553	545	517
	11	12	25	No	do.	554	542	517
	12	20	18	Yes	do.	554	534	516
	13	18	21	No	do.	554	536	515
	14	15	23	No	do.	554	539	515
02-1/2	12	22	15	Yes	do.			
	13	23	20	Yes	do.			
	14	16	22	No	do.			
02	5	9	39	No	do.	547	538	499
	7	5	42	No	do.	549	544	502
	9	7	37	No	do.	551	544	507
	10	9	32	Yes	do.	551	542	510
	11	7	36	Yes	do.	551	544	508
	12	10	37	Yes	do.	552	542	505
	13	15	32	Yes	do.	552	537	505
	14	18	22	No	do.	552	534	512
	15	20	25	No	do.	552	532	507
	17	10	31	No	do.	552	542	511
	19	12	34	No	do.	553	541	507
	21	14	24	No	do.	553	539	515
01	8	10	33	Yes	do.	546	536	502
	9	6	37	No	do.	545	539	502
	10	15	30	Yes	do.	545	530	500
	11	9	30	Yes	do.	547	538	508
	12	8	34	Yes	do.	549	541	507
	13	12	30	Yes	do.	549	537	507

Fr. = Frozen. Th. = Thawed.

TABLE 5. - Summary drill-hole prospect data, Tofty and Idaho Gulches (Con.)

Published by permission of owner:

Line No.	Hole No.	Depth O.B., ft.	Depth gravel, ft.	Tin, present	Ground condition	Surface elev., ft.	Top gravel elev., ft.	Top bedrock elev., ft.
2	5	24	20	Yes	Fr.	538	514	494
	7	10	34	Yes	do.	540	530	496
	9	12	38	Yes	do.	542	530	492
	11	18	30	Yes	do.	541	523	493
	13	18	22	No	do.	542	524	502
	15	18	21	No	do.	542	524	503
	17	16	22	Yes	do.	543	527	505
	19	18	20	No	do.	544	526	506
	21	16	25	No	do.	545	529	504
6	03	32	6	No	Fr. & Th.	530	498	
	01	40	32	Yes	Fr.	530	490	458
	1	34	38	Yes	do.	529	495	457
	5	28	40	Yes	do.	530	502	462
	7	33	34	Yes	do.	529	496	462
	9	34	25	Yes	do.	529	495	470
	11	39	19	No	do.	531	492	473
	13	12	46	Yes	do.	532	520	474
	15	33	34	Yes	do.	534	501	467
	17	28	33	Yes	do.	542	514	481
	19	28	27	Yes	do.	537	509	482
	21	25	30	Yes	do.	538	513	483
8	1	33	38	Yes	Fr.	526	493	455
	5	26	41	Yes	do.	526	500	459
	7	28	38	Yes	do.	527	499	461
	9	34	31	Yes	do.	529	495	464
	11	36	27	Yes	do.	528	492	465
	13	34	29	Yes	do.	530	496	467
	15	36	30	Yes	do.	533	497	467
	17	43	24	Yes	do.	537	494	470
	19	40	22	No	do.	537	497	475
	21	30	29	Yes	do.	536	506	477
10	1	40	30	Yes	do.	523	483	453
	3	35	35	Yes	do.	523	488	453
	5	36	32	No	do.	525	489	457
	7	35	33	No	do.	527	492	459
	9	35	34	No	do.	529	594	460
	11	29	40	Yes	do.	528	499	459
	13	30	36	No	do.	529	499	463
Q	04	5	40	No	do.	552	547	507
	02	8	44	Yes	do.	546	538	494
	0	7	44	No	do.	542	535	491
	2	12	38	No	do.	537	525	487
	4	18	36	No	do.	534	516	490
	6	33	28	Yes	do.	529	496	468
	8	31	42	Yes	do.	527	496	454
O-Q	2	15	20	No	do.	560	545	525
	4	17	27	No	do.	559	542	515
	6	12	24	No	do.	558	546	520
	8	10	30	Yes	do.	554	544	514

Fr. = Frozen. Th. = Thawed.

TABLE 6. - Summary drill-hole data, Sullivan Creek

Line No.	Hole No.	Depth O.B., ft.	Depth gravel, ft.	Tin, present	Ground condition	Surface elev., ft.	Top gravel elev., ft.	Top bedrock elev., ft.
S-5	11	22	5		Fr.	617	595	590
	12	20	5		do.	616	596	591
	13	27	5		do.	621	594	589
	14	29	8		do.	632	603	595
	15	34	2		do.	635	601	599
	16	41	5		do.	638	597	592
	17	42	2		do.	641	599	597
	18	42	4		do.	644	602	598
	19	48	4		do.	647	599	595
	20	50	6		do.	651	601	595
	21	48	8		do.	655	607	597
	22	52	13		do.	658	606	593
	23	55	13		do.	662	607	594
	24	62	4		do.	665	603	599
	25	67	3		do.	668	601	598
	26	66	6		do.	672	606	600
S	11	36	4		do.	624	588	584
	12	35	9		do.	627	592	583
	13	36	9		1/	630	594	585
	14	39	10		1/	634	595	585
	15	43	6		1/	636	593	587
	16	47	4		1/	640	593	589
	17	53	3		1/	645	592	589
	18	57	4		1/	648	591	587
	19	60	0		1/	652	592	592
	20	66	2		1/	658	592	590
	21	65	4		Fr.	662	597	593
	22	68	2		do.	666	598	596
	23	67	9		do.	668	601	592
	24	70	9		do.	670	600	591
	25	71	8		do.	670	599	591
	26	68	9		do.	670	599	592
	27	70	15		do.	670	600	585
	28	72	15		do.	671	599	584
	29	75	11		do.	674	599	587
S-P	S-8	37	5		do.	608	571	566
	S-7	39	1		do.	610	573	572
	S-4	41	4		do.	614	573	569
	S-3	44	4		1/	612	568	564
	P-2	8	4		1/	579	571	567
	P-6	9	4		1/	581	572	568
	P-7	13	0		1/	584	571	571

Fr. = Frozen.
1/ = Mined out.

TABLE 6. - Summary drill-hole data, Sullivan Creek (Con.)

Line No.	Hole No.	Depth O.B., ft.	Depth gravel, ft.	Tin, present	Ground condition	Surface elev., ft.	Top gravel elev., ft.	Top bedrock elev., ft.
3	6	44	2		Fr.	609	565	563
	7	46	5		do.	609	563	558
	8	50	2		do.	612	562	560
	9	50	2		do.	614	564	562
	10	48	8		do.	616	568	560
	11	54	0		1/	618	564	
5	5	43	6		do.	605	562	556
	6	45	4		do.	605	560	556
	7	43	6		do.	606	563	557
	8	44	7		do.	607	563	556
	9	43	6		do.	607	564	558
	10	45	3		do.	608	563	560
	11	45	4		do.	608	563	559
7-1/2	4	38	9		2/	593	555	546
	5	40	10		2/	595	555	545
	6	43	6		2/	596	553	547
	7	42	9		2/	599	557	548
	8	42	8		2/	598	556	548
	9	43	8		2/	599	556	548
	10	41	10		2/	599	558	548
8-1/2	3	45	5		2/	597	552	547
	5	43	12		2/	596	553	541
	6	39	14		2/	596	556	542
	7	40	12		2/	596	556	544
	8	38	11		2/	595	557	546
	9	40	7		2/	595	555	548
	10	43	6		2/	596	553	547
9-1/2	6	39	12		2/	594	555	543
	7	40	9		2/	592	552	543
	8	39	9		2/	591	552	543
	9	40	7		2/	591	551	544
	10	48	2		2/	592	544	542
	11	45	3		2/	593	548	545
	12	47	1		2/	594	547	546
	13	47	1		2/	594	547	546
	14	45	1		2/	596	551	550

Fr. = Frozen.
1/ = Old workings.
2/ = Mined out.

TABLE 6. - Summary drill-hole data, Sullivan Creek (Con.)

Line No.	Hole No.	Depth O.B., ft.	Depth gravel, ft.	Tin present	Ground condition	Surface elev., ft.	Top gravel elev., ft.	Top bedrock elev., ft.
10-1/2	6	32	13		Fr.	584	552	539
	7	38	8	1/		585	547	539
	8	40	6	1/		588	548	542
	9	42	3	1/		589	547	544
	10	42	4	1/		589	547	543
	11	40	4	1/		590	550	546
	12	44	3	1/		591	547	544
	13	43	3	1/		592	549	546
	15	41	6	1/		594	553	547
	17	6	3	Yes	Fr.	562	556	553
	18	5	5	No	do.	562	557	552
	19	5	8	No	do.	562	557	549
	20	0	8	Yes	do.	563	563	555
	21	0	9	Yes	do.	563	563	554
	22	0	18	Yes	do.	570	570	552
11	8	38	8		do.	586	548	540
	9	39	7		do.	587	548	541
	10	39	8		do.	588	549	541
	11	40	8		do.	590	550	542
	12	41	6		do.	591	550	544
	13	46	3		do.	592	546	543
	18	0	12		do.	561	561	549
	19	0	13		do.	562	562	549
13	7	46	11	Yes	do.	590	534	523
	9	50	8	No	do.	592	542	534
	11	52	10	Yes	do.	595	543	533
	13	53	12	Yes	do.	600	547	535
	15	56	9	Yes	do.	601	545	536
14	9	49	10	Yes	do.	590	541	531
	11	50	8	No	do.	592	542	534
	13	53	7	No	do.	595	542	535
	15	56	8	Yes	do.	597	541	533
	17	60	10	Yes	do.	603	543	533
	19	64	9	Yes	do.	606	542	533
	21	67	9	Yes	do.	611	544	535
	23	75	2	No	do.	617	542	540

Fr. = Frozen.
1/ = Mined out.

TABLE 6. - Summary drill-hole data, Sullivan Creek (Con.)

Line No.	Hole No.	Depth O.B., ft.	Depth gravel, ft.	Tin present	Ground condition	Surface elev., ft.	Top gravel elev., ft.	Top bedrock elev., ft.
A	14	49	8	No	Fr.	634	585	577
	16	53	8	No	do.	632	579	571
	18	50	18	No	do.	638	588	570
	20	59	12	No	do.	641	582	570
	22	68	12	No	do.	647	579	567
	24	61	9	No	do.	652	591	582
	26	26	4	No	do.	660	634	630
	28	23	2	No	Fr. & Th.	669	646	644
	30	24	30	No	Fr.	674	650	620
	32	41	1/ 6	No	do.	668	1/627	621
	34	35	1/ 9	No	do.	661	1/626	617
	36	20	1/20			655	1/645	625
	38	33	1/25	No	-	647	1/614	589
	40	46	1/ 4	No	Fr.	641	1/595	591
C	2	23.75	7	No	do.	582	558	551
	3	25	6	No	do.	583	558	552
	4	27	7	No	do.	584	557	550
	5	29.5	7	No	do.	585	555	548
	6	30	9	No	do.	589	559	550
	7	35	11	No	do.	594	559	548
D-F	2	41	16	Yes	do.	614	541	531
	3	73	10	Yes	do.	612	539	529
	4	73	10	Yes	do.	609	537	526
	6	72	11	Yes	do.	607	535	525
	8	72	10	Yes	do.	606	538	519
	10	68	19	Yes	do.	600	532	513
F-H	2	67	14	Yes	do.	594	527	513
	6	65	14	Yes	do.	594	529	515
	8	61	18	Yes	do.	588	527	509
E	9	23	10	No	do.	568	545	535
	10	23	12	No	do.	571	549	537
	11	22	11	No	do.	571	549	538
	12	26	10	No	do.	572	546	536
	13	24	15	No	do.	577	553	538
	14	30	12	No	do.	577	547	535

Fr. = Frozen.
Th. = Thawed.
1/ = Slide.

TABLE 6. - Summary drill-hole data, Sullivan Creek (Con.)

Line No.	Hole No.	Depth O.B., ft.	Depth gravel, ft.	Tin present	Ground condition	Surface elev., ft.	Top gravel elev., ft.	Top bedrock elev., ft.
F	11	22	8	No	Fr.	565	543	535
	12	27	10	No	do.	568	541	531
	13	24	16	No	do.	570	546	530
G	2	6	10	No	do.	548	542	532
	3	10	6	No	do.	548	538	532
	4	4	11	No	do.	547	543	532
	5	9	8	Yes	do.	548	539	531
	6	11	10	Yes	do.	548	537	527
	7	9	13	Yes	do.	548	539	526
	8	6	15	No	do.	547	541	526
	9	8	14	No	do.	549	541	527
	10	16	12	No	do.	551	535	523
H	8	7	14	No	do.	541	534	520
	9	7	14	No	do.	543	536	522
	12	15	16	No	do.	545	530	514
	14	18	17	No	do.	549	531	514
	16	21	20	No	do.	557	536	516
	18	26	21	No	do.	561	535	514
	20	38	18	No	do.	569	531	513
	22	46	18	No	do.	575	529	511
	24	56	21	No	do.	582	526	505
	26	67	20	Yes	do.	594	527	507
	28	75	22	No	do.	602	527	505
	30	79	10	No	Fr. & Th.	607	528	518
I	1	16	10	No	Fr.	554	538	528
	3	14	8	No	do.	546	532	524
	5	13	6	No	do.	538	525	519
	7	7	14	No	do.	538	531	517
	8	5	15	No	do.	538	533	518
	9	9	11	No	do.	537	528	517

Fr. = Frozen.
Th. = Thawed

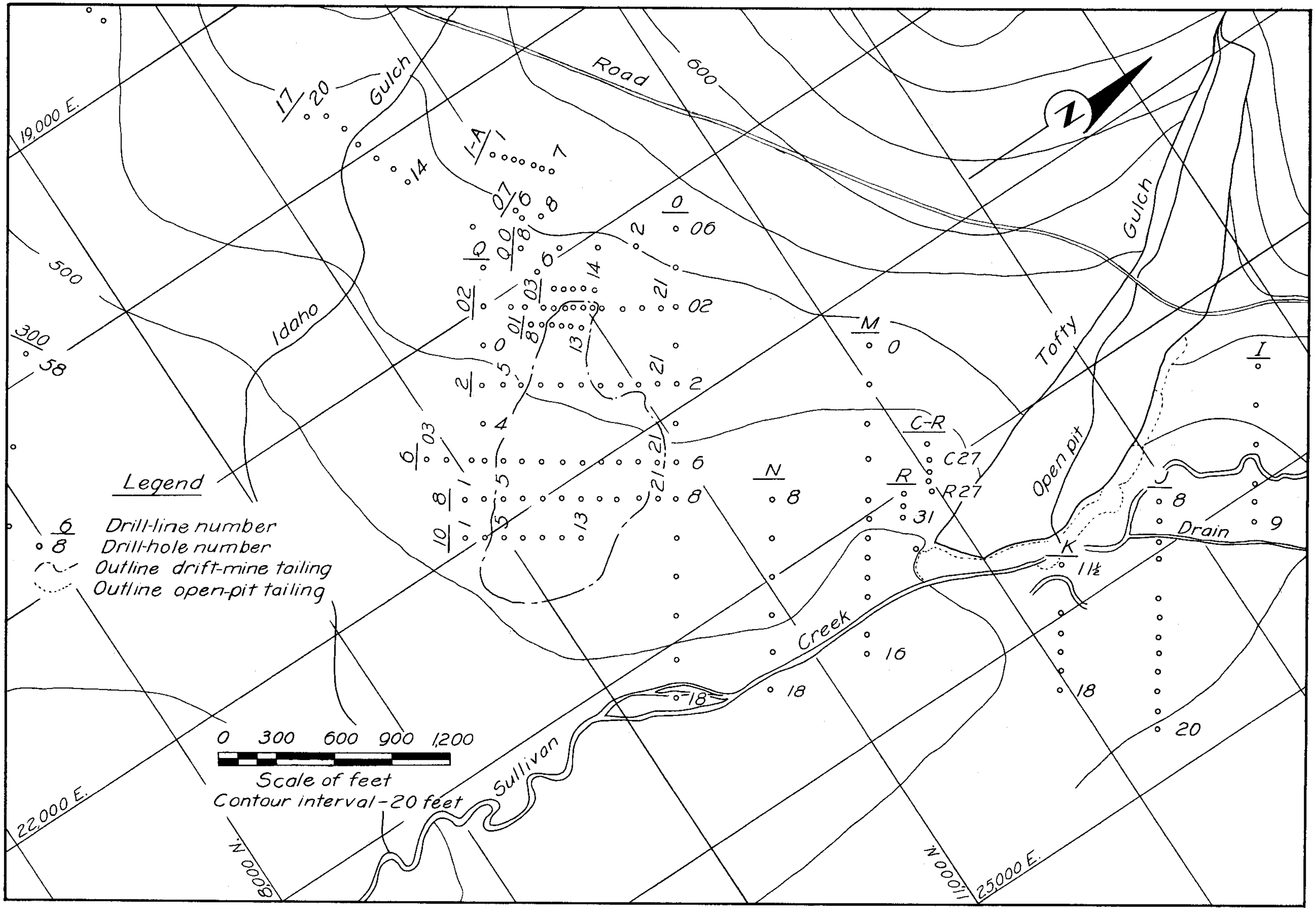

Figure 15. - Topographic map, with churn-drill-hole sites, Tofty and Idaho Gulches.

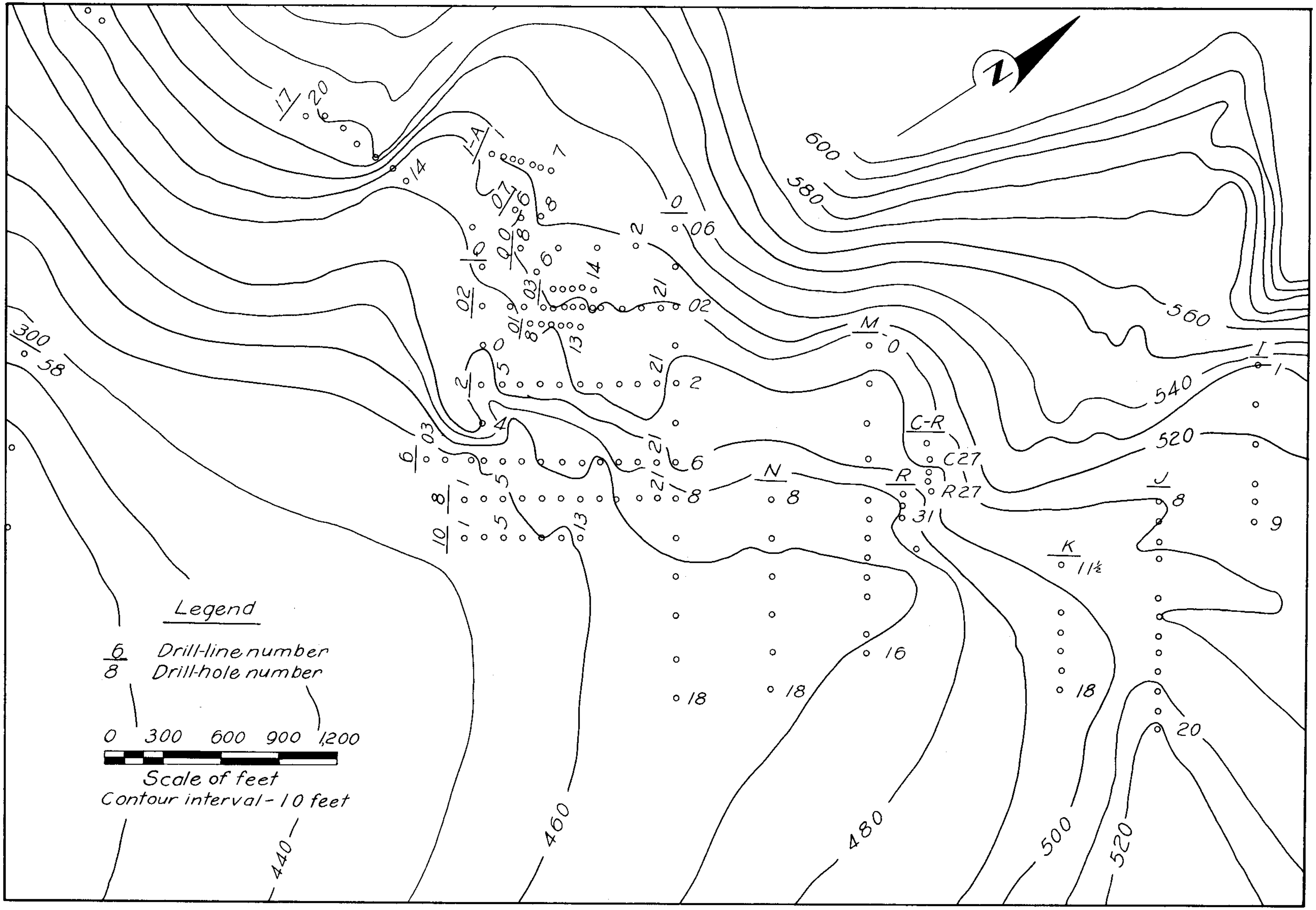

Figure 16. - Bedrock topographic map, with churn-drill-hole sites, Tofty and Idaho Gulches.

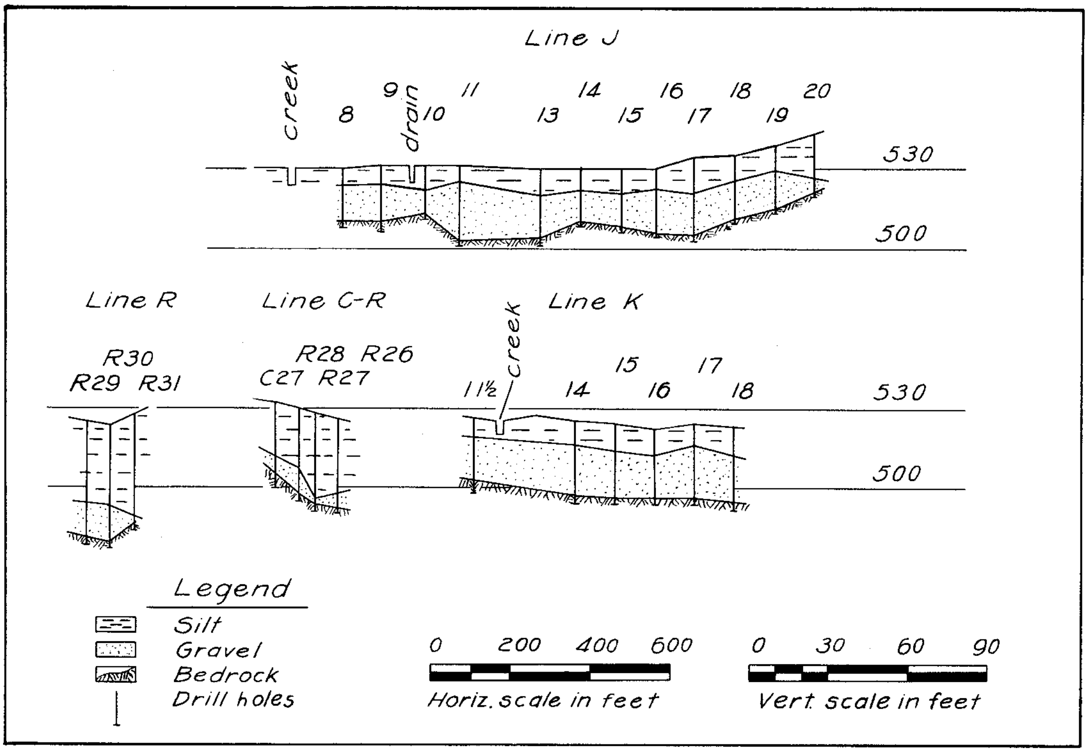

Figure 17. - Placer sections, drill lines J, R, C-R, and K.

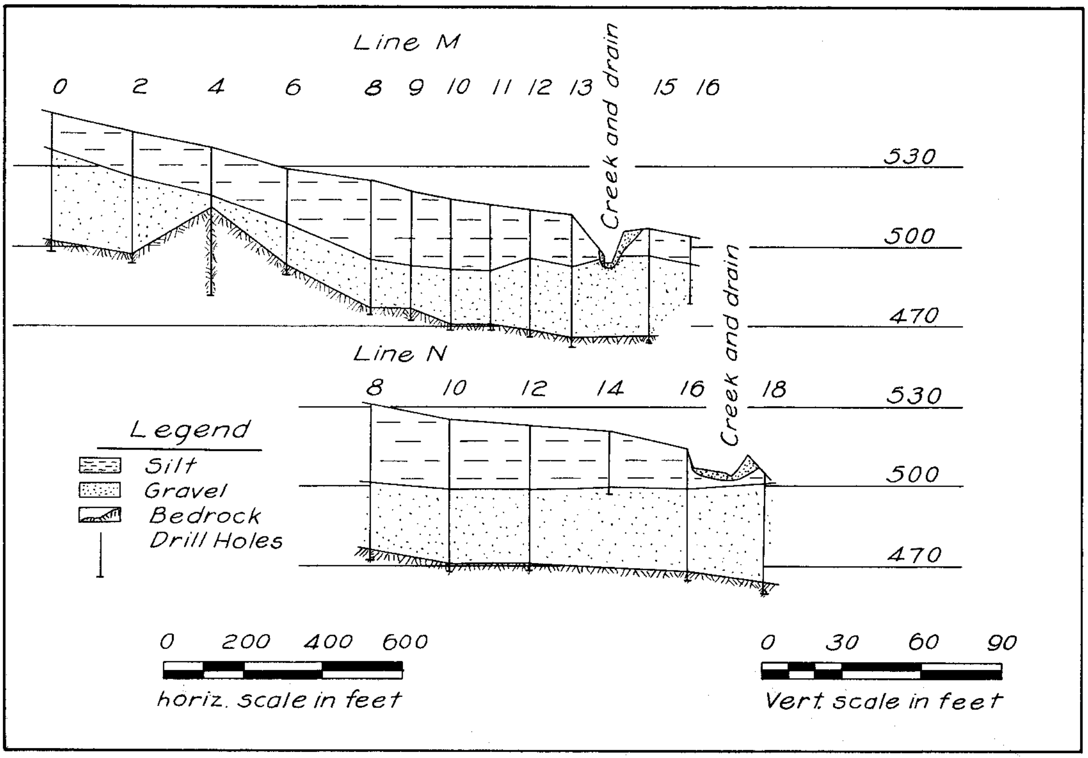

Figure 18. - Placer sections, drill lines M and N.

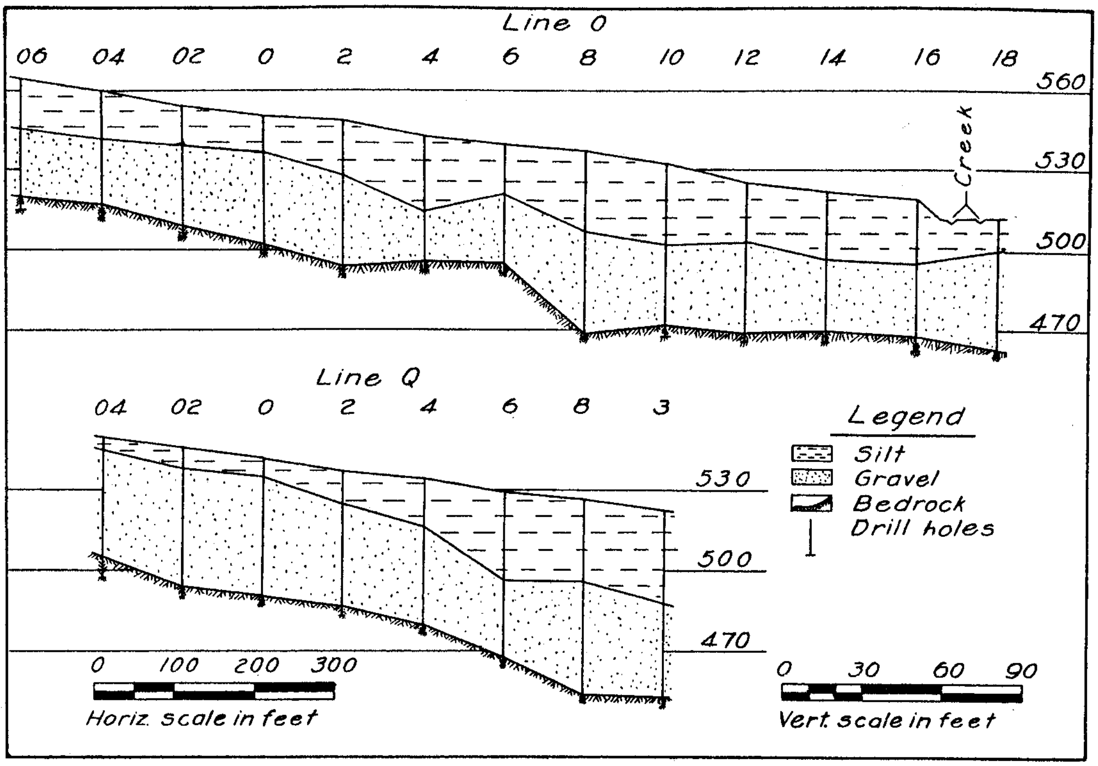

Figure 19. - Placer sections, drill lines O and Q.

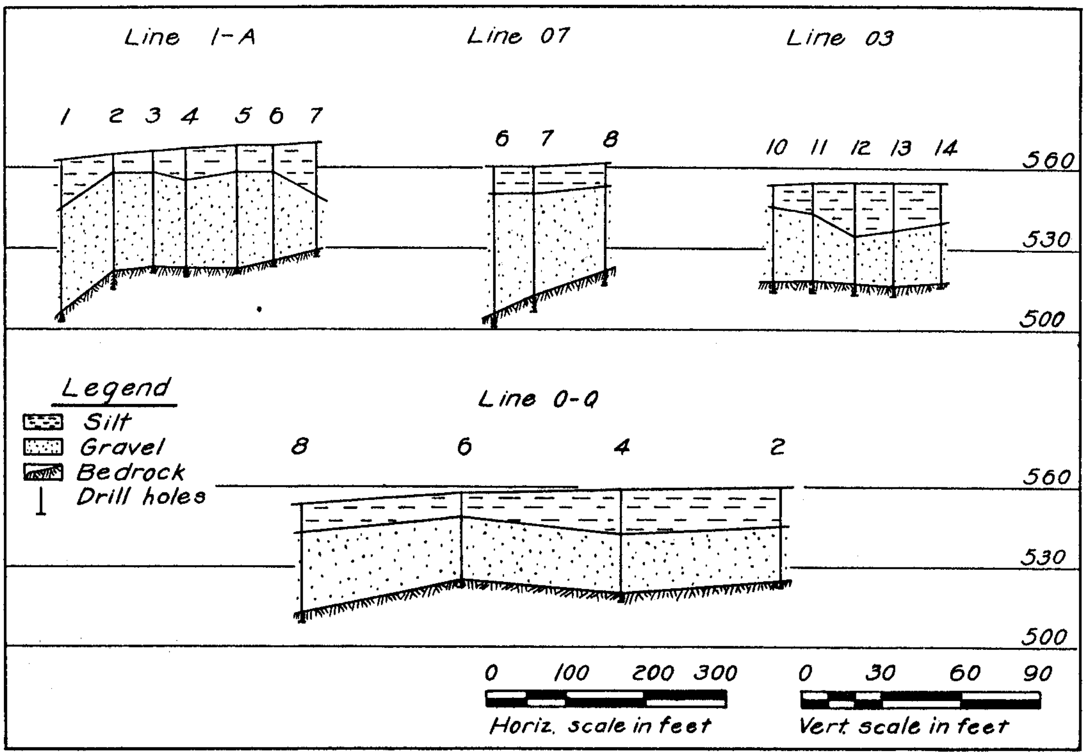

Figure 20. - Placer sections, drill lines 1-A, 07, 03, and O-Q.

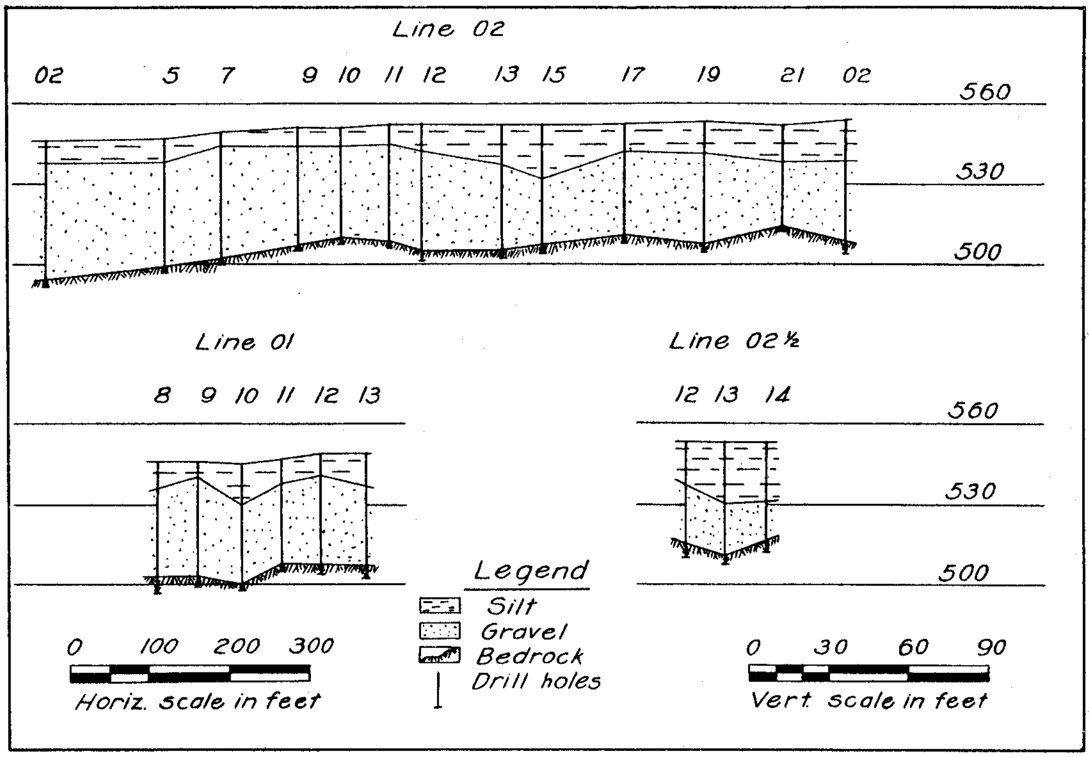

Figure 21. - Placer sections, drill lines 02, 01, and 02½.

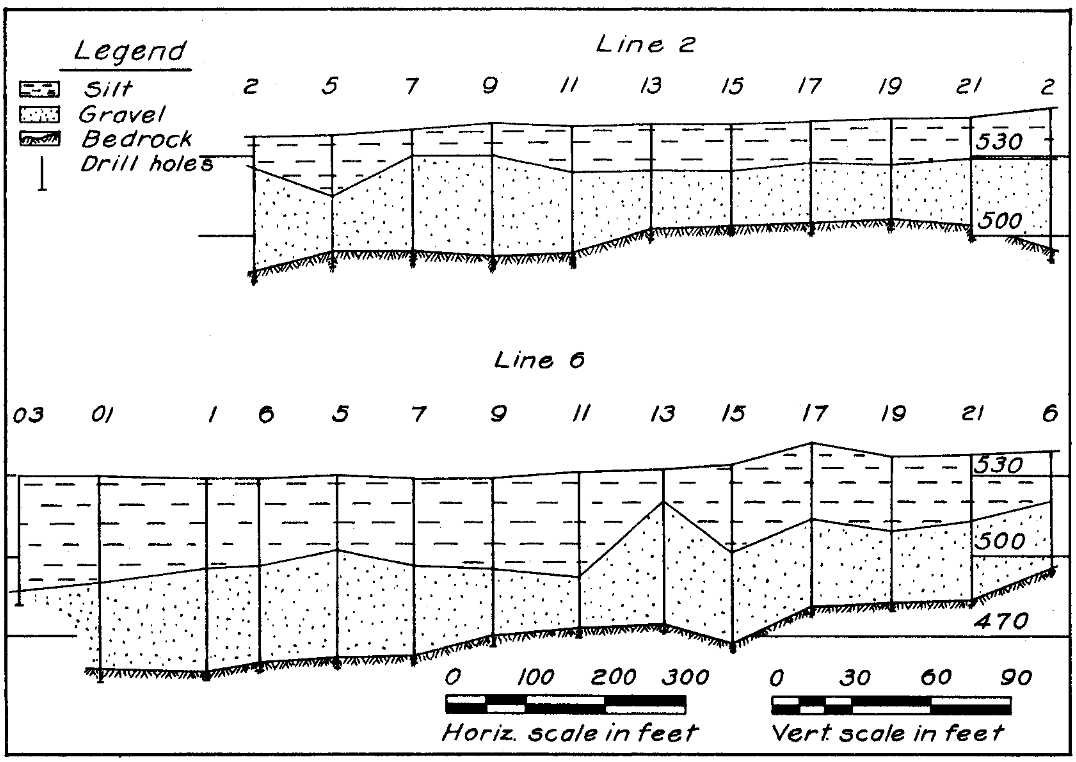

Figure 22. - Placer sections, drill lines 2 and 6.

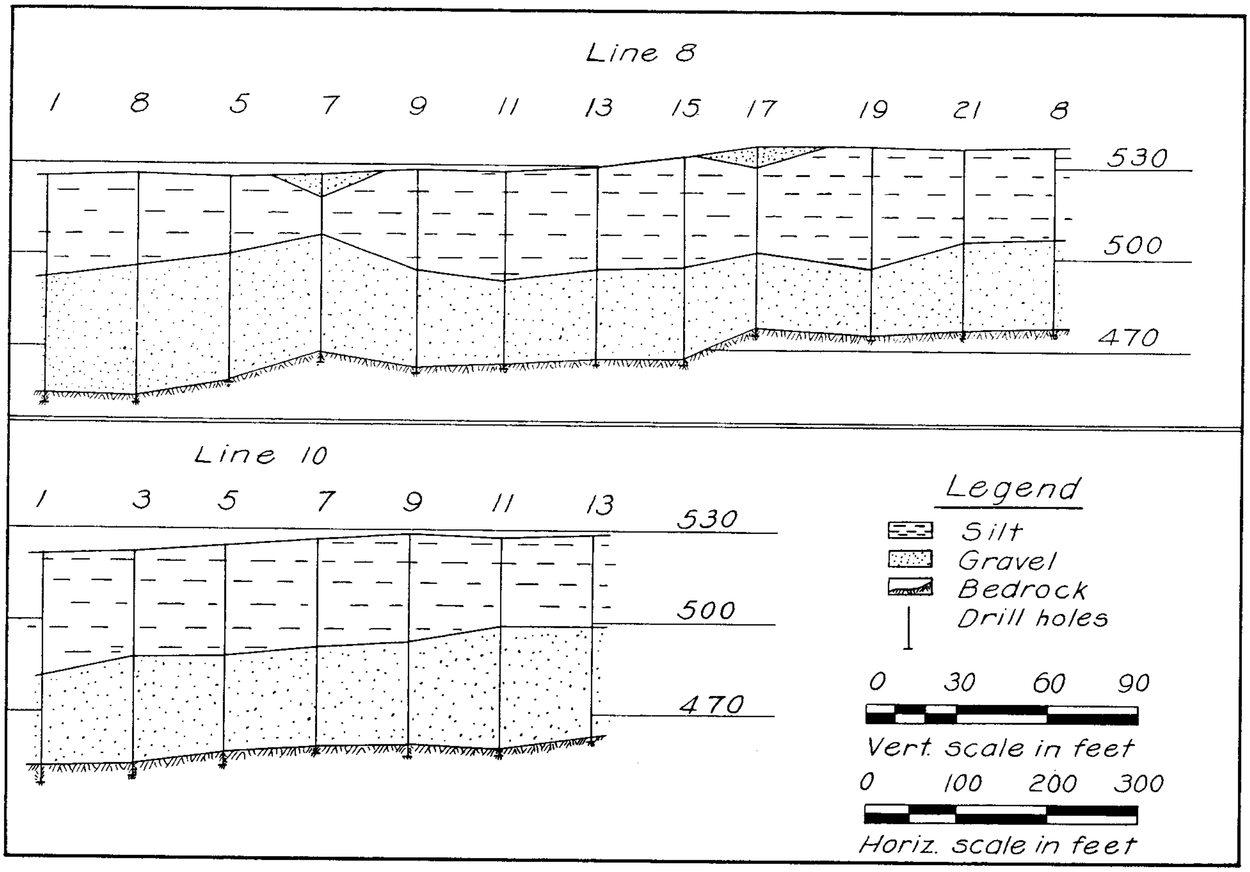

Figure 23. - Placer sections, drill lines 8 and 10.

Tailing-Pile Sampling Methods and Results

Sampling was done on 11 drift-mine tailing piles (fig. 33), which were selected as representative of the numerous underground mining operations on the several principal placer channels along the tin belt; many tailing piles were not tested but are believed to be of similar composition.

Except during the occasional periods when tin commanded high prices, the cassiterite customarily was discarded with the gold-placer tailing. The tailing piles are therefore a potential source of tin and also are roughly indicative of the tin content of mining sections in unworked portions of the various pay channels.

Because of the generally flat topography, sluicebox grade was obtained by elevating the boxes. The placer gravels were lifted to the head of the elevated box, usually by means of a bucket operating on a cable suspended from a ginpole at the head of the box. As washing proceeded, the tailing boxes were extended outward from the ginpole, and sections were added as necessary to deflect the washed material away from the riffle boxes. Consequently, most of the tailing piles are roughly elliptical and are deepest along the long axis of the piles.

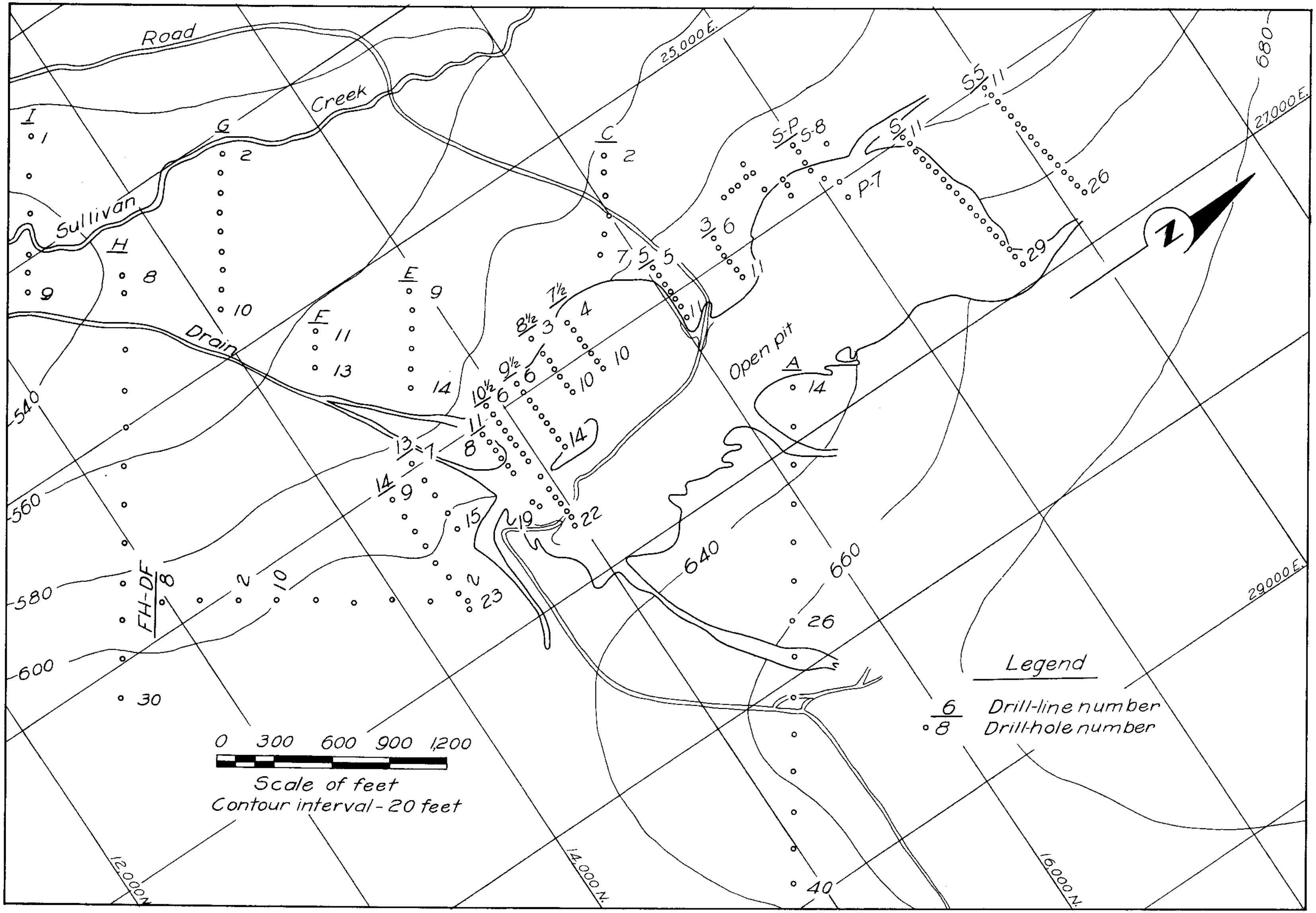

Figure 24. - Topographic map, with churn-drill-hole sites, Sullivan Creek.

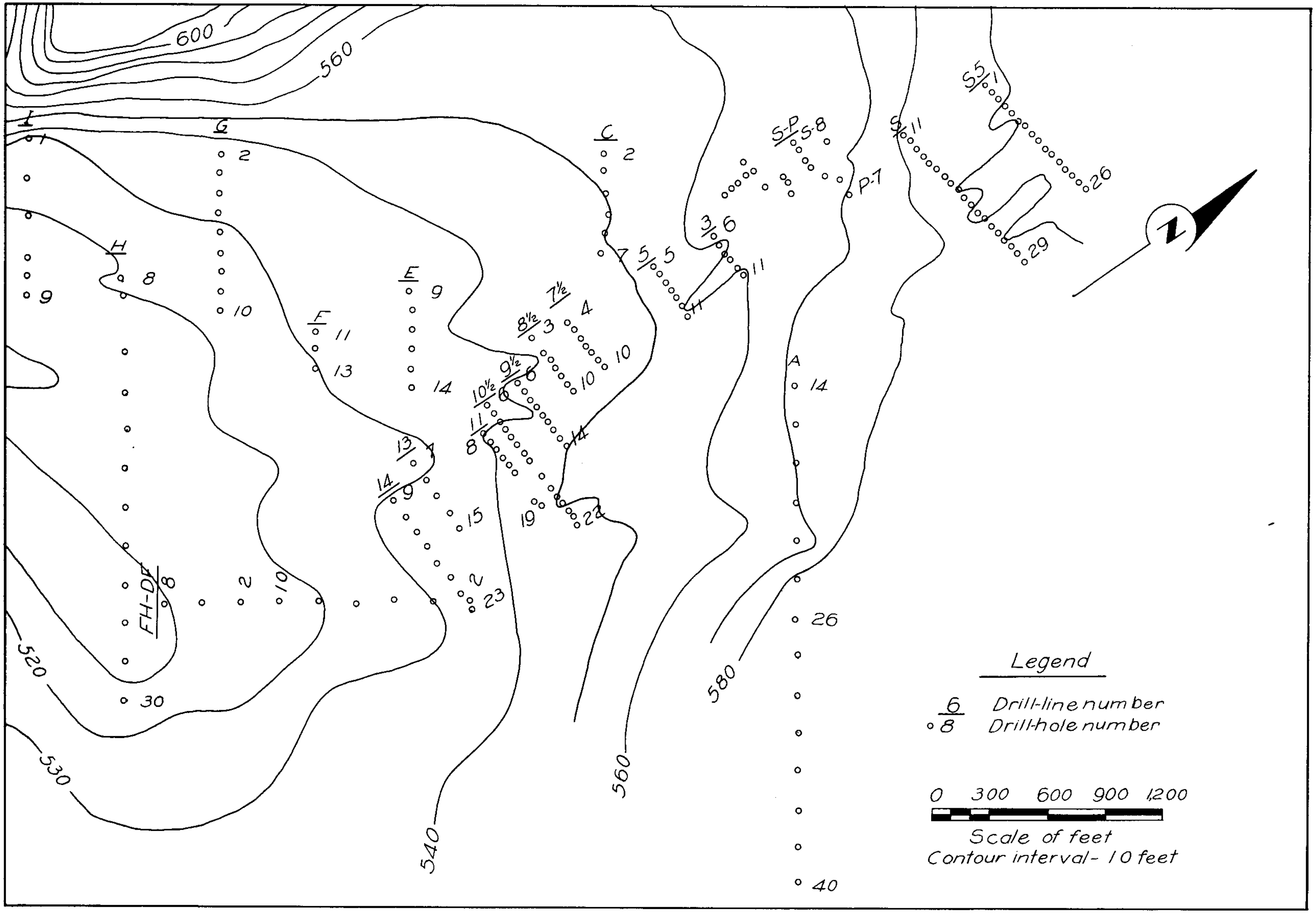

Figure 25. - Bedrock topographic map, with churn-drill-hole sites, Sullivan Creek.

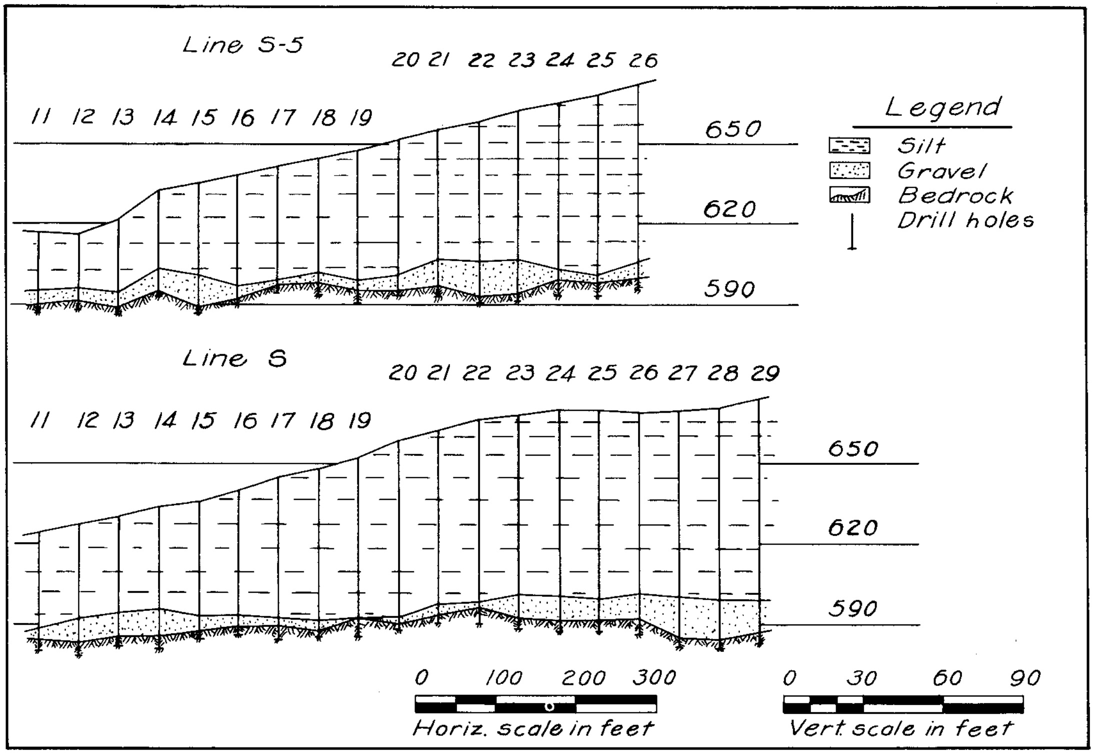

Figure 26. - Placer sections, drill lines S-5 and S.

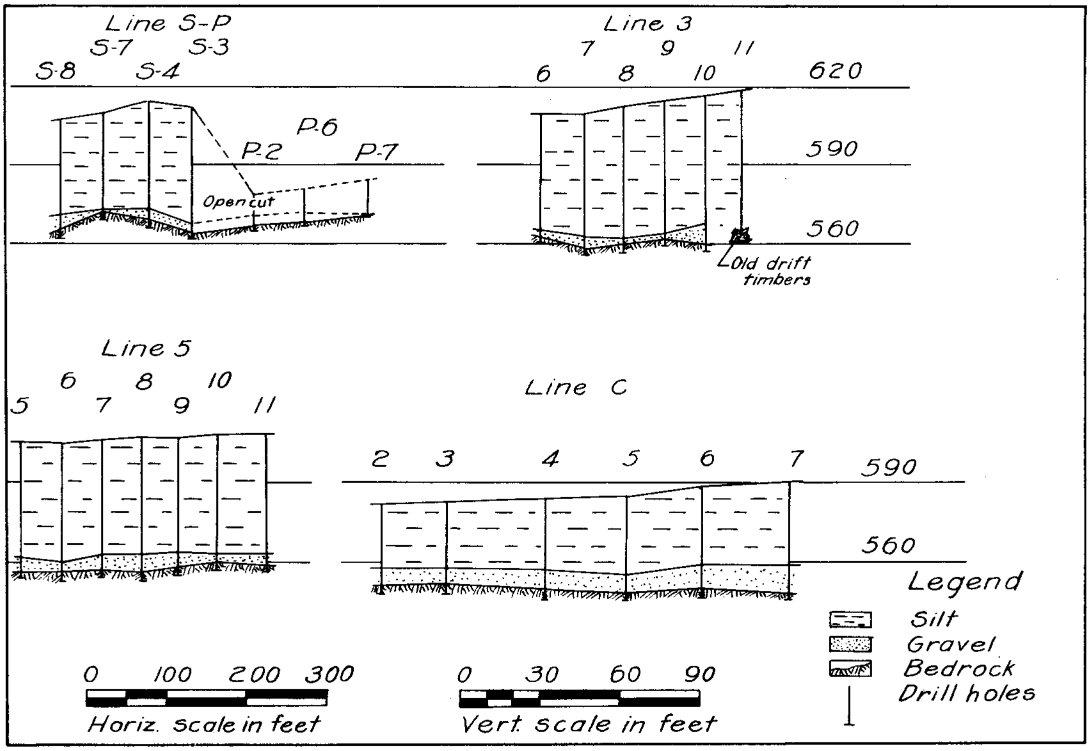

Figure 27. - Placer sections, drill lines S-P, 3, 5, and C.

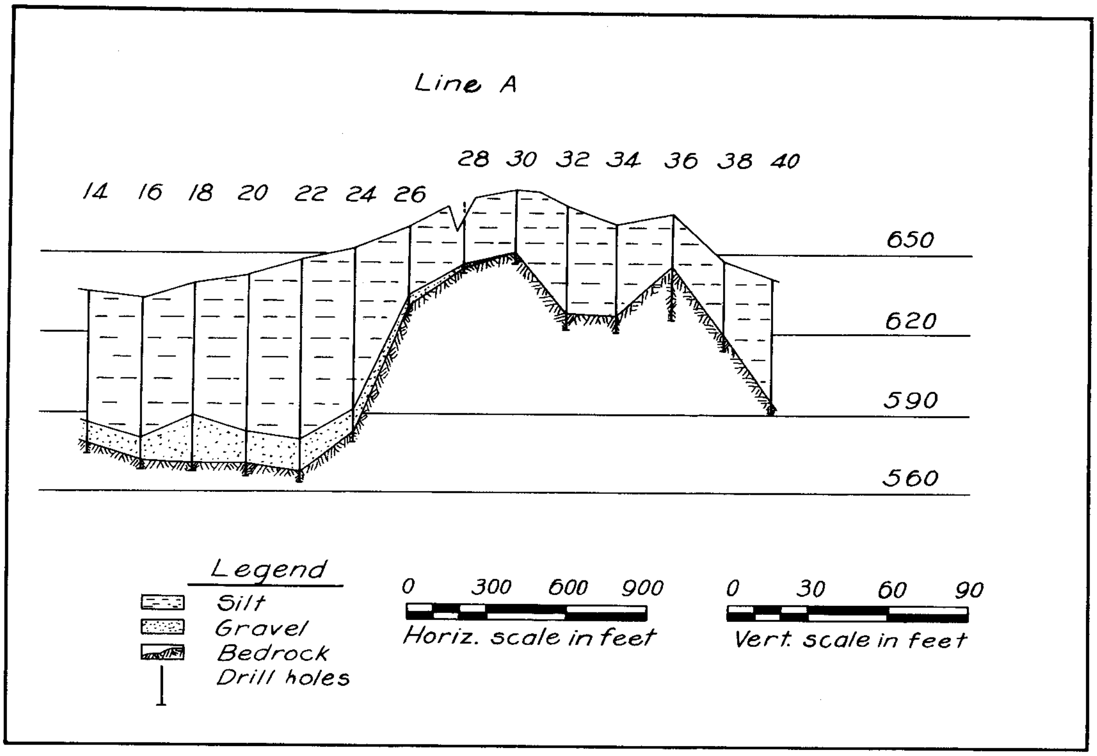

Figure 28. - Placer section, drill line A.

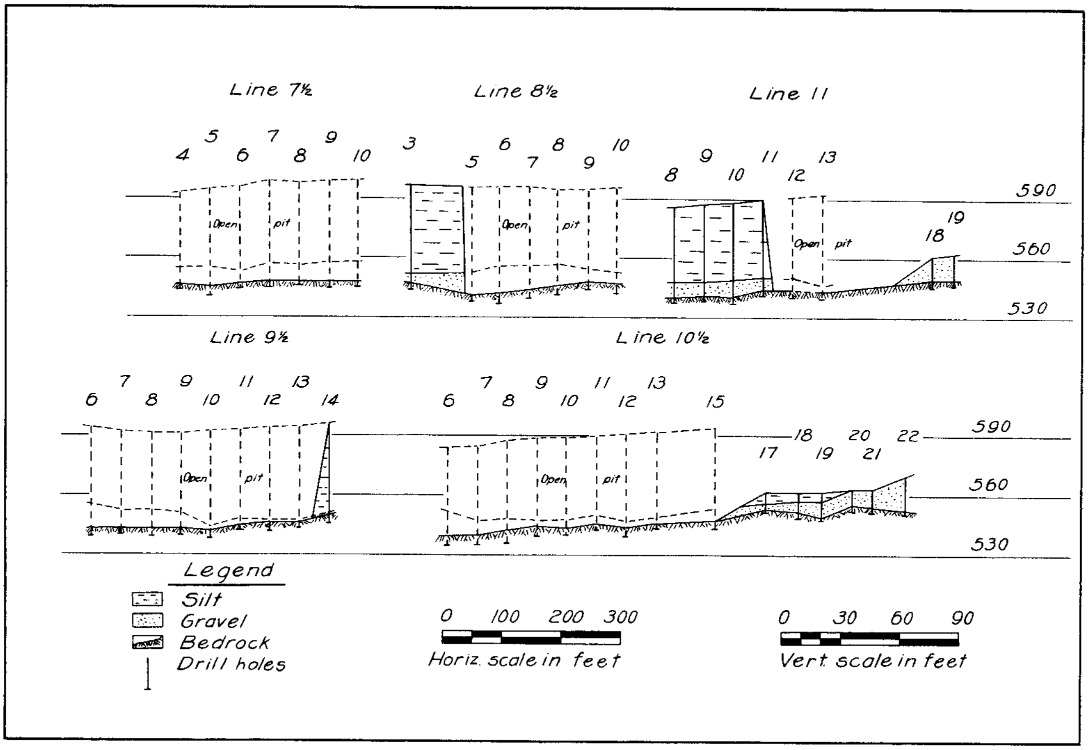

Figure 29. - Placer sections, drill lines 7½, 8½, 11, 9½, and 10½.

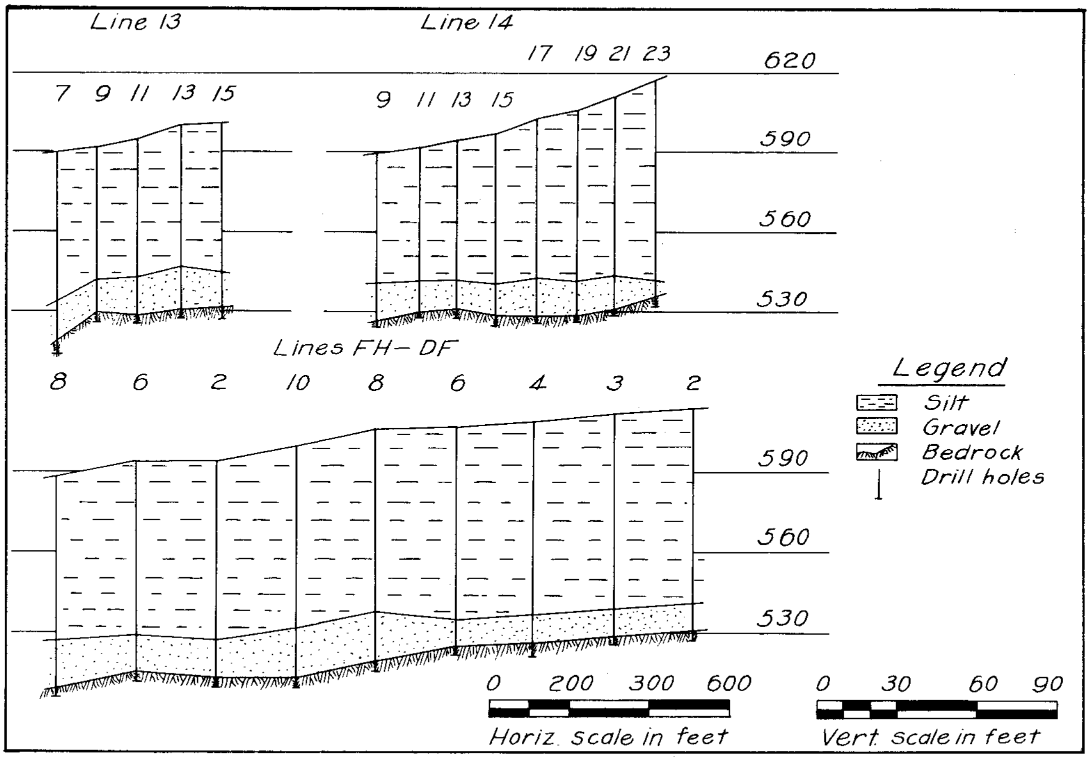

Figure 30. - Placer sections, drill lines 13, 14, and FH-DF.

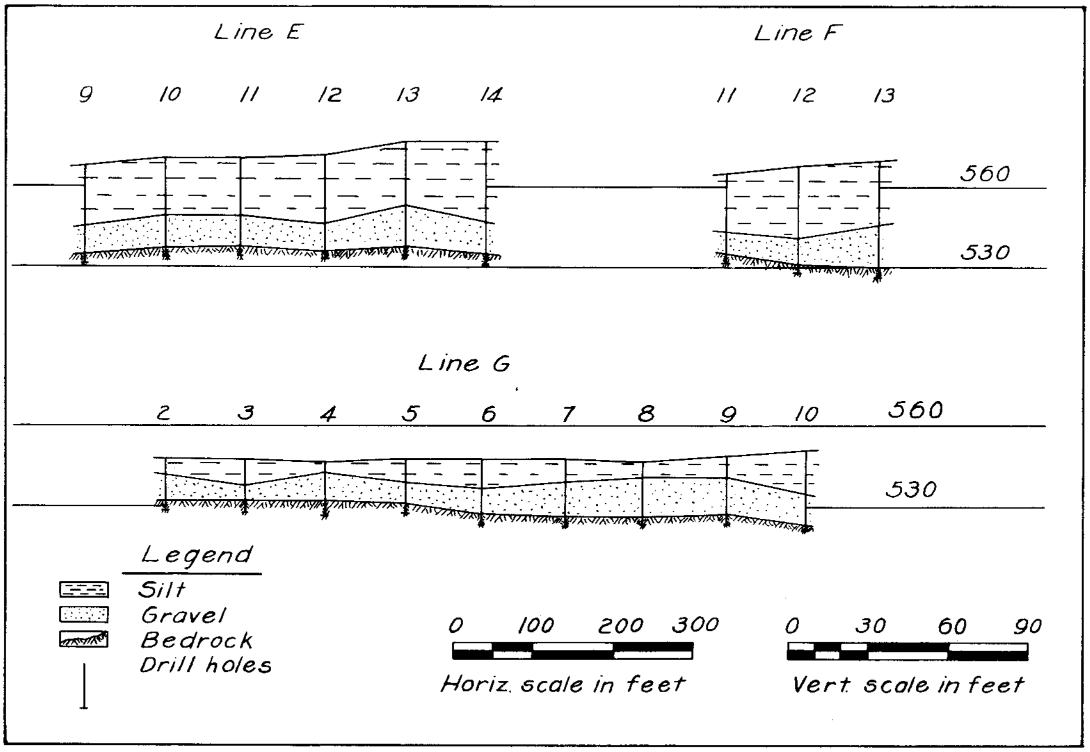

Figure 31. - Placer sections, drill lines E, F, and G.

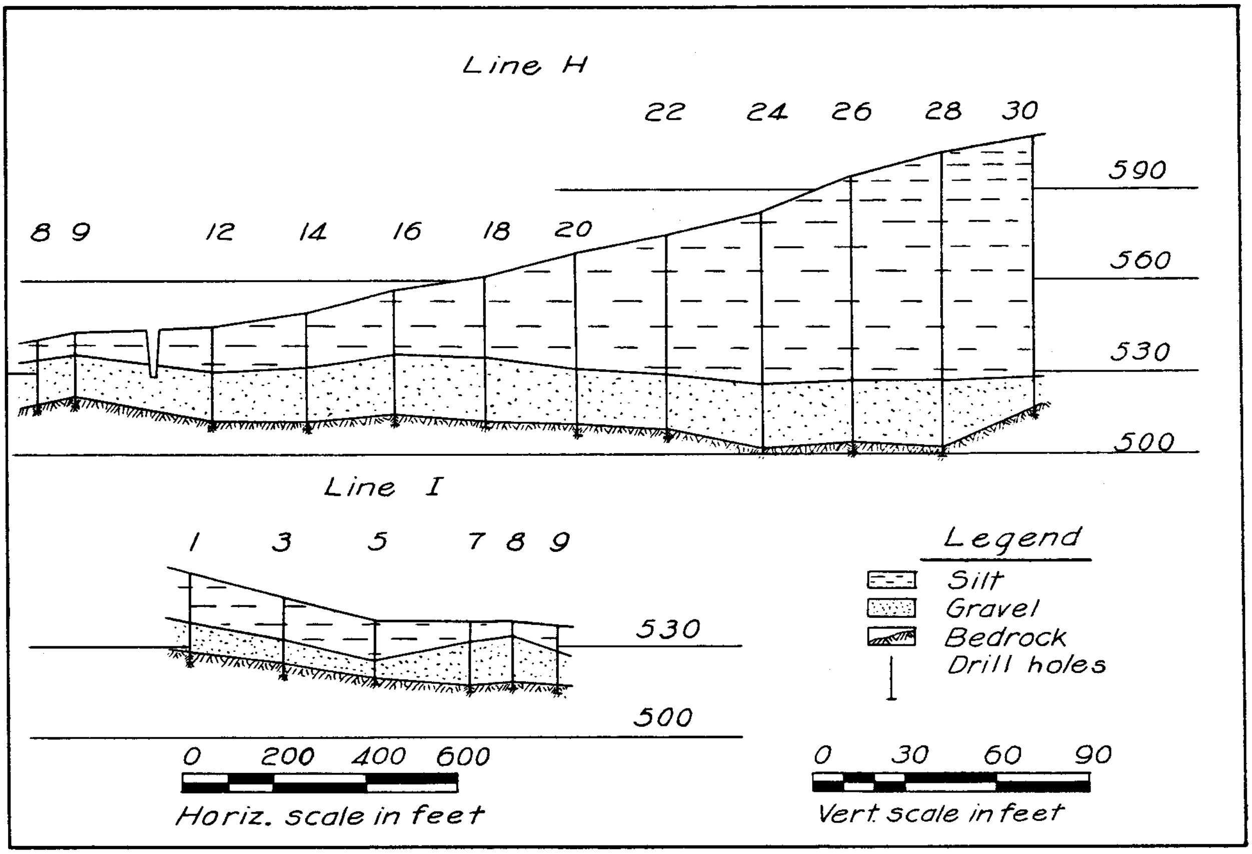

Figure 32. - Placer sections, drill lines H and I.

To obtain uniform samples, bulldozer trenches were cut across the center and to the full depth of the tailing piles wherever possible. Channel samples 1 foot wide and 1 foot deep were cut from top to bottom of the vertical-sided bulldozer trenches. The large samples thus obtained were panned to produce a clean concentrate; tailing from panning was put through a rocker from which a "rough concentrate from rocker" was obtained.

Tailings from pan and rocker were carefully examined and all coarse pebbles and cobbles containing cassiterite were included with the concentrate. The larger cobbles generally are low grade, although the tin content may differ considerably, as is shown by the following analyses of cobbles picked at random from the tailing piles.

TABLE 7. - Assay of tin cobbles

Cobble weight, grams	Tin assay, percent
398.4	0.1
378.8	.2
321.4	18.0
147.6	38.6

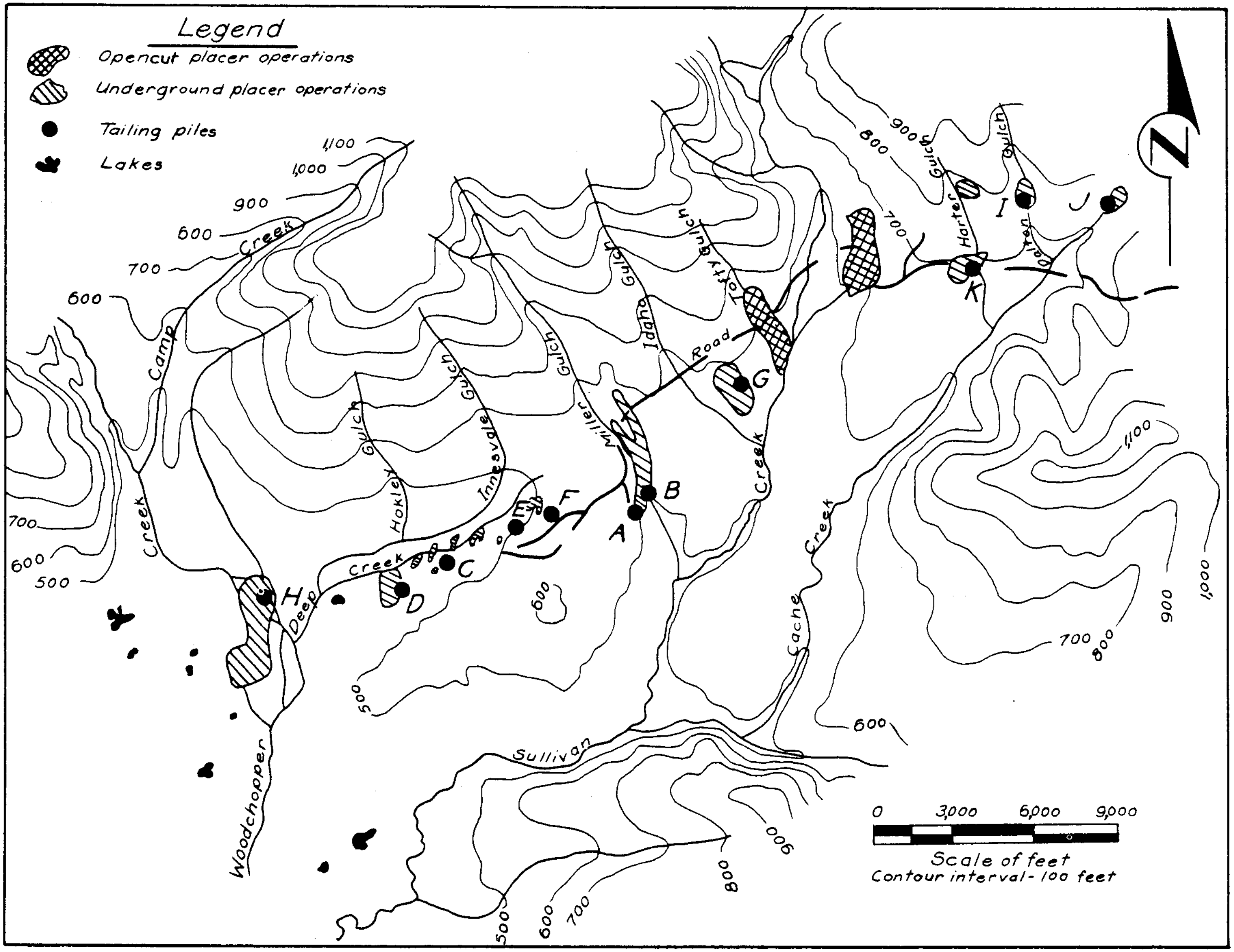

Figure 33. - Index map of tailing-pile sampling.

The proportion of large cobbles of tin-bearing material in the deposits has not been determined, but visual inspection of the placer tailing dumps and the small amount of coarse ore recovered from the channel samples indicates that the percentage of ore in pieces larger than 1 inch in diameter is comparatively small.

All tailing-pile-concentrate samples were sent to the Bureau of Mines laboratory in Juneau for tin analyses, separation of free gold, and preliminary examination for other heavy minerals. A typical sample of concentrate from tailing piles in the Deep Creek area was sent to the Bureau laboratory at Albany, Oreg., for spectrographic analyses. Results are reported in table 8 as follows:

TABLE 8. - Spectrographic analyses of concentrates from Deep Creek area

Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn
F	A-B	-	-	E	E	F	-	D	-	-	C-D	F	A	-	-	D	D
Mo	Na	Ni	Cb	P	Pb	Pt	Sb	Si	Sn	Sr	Ta	Ti	V	W	Zn	Zr	
-	-	D	C-D	-	D	-	-	A	A	-	-	C+	C	-	-	C	

Legend: A - Over 10 percent; B - 5 to 10 percent; C - 1 to 5 percent; D - 0.1 to 1 percent; E - 0.01 to 0.1 percent; F - 0.001 to 0.01 percent; G - Under 0.001 percent; - = Not detected

Petrographic studies of concentrate from tailing piles in the Deep Creek area and from other parts of the tin belt indicated that, in addition to gold and cassiterite, small but varying amounts of ilmenite, rutile, chromite, magnetite, scheelite, zircon, monazite, columbite, eschynite, and ellsworthite were present.

Tailing-pile sampling results are summarized in tables 9 through 19; sample locations and topographic surveys of the sampled piles are shown in figures 34 through 44.

TABLE 9. - Summary of channel-sampling results, tailing pile A, Miller Gulch

Channel No.	Vol. in place, cu. ft.	Conc. recovered, lb.	Gold recovered, mg.	Conc. analyses		Recovery per cu. yd.			
				Tin, percent	Cb_2O_5, percent	Conc., lb.	Tin, lb.	Cb_2O_5, lb.	Gold, oz.
1	4.50	0.340	27.63	21.7	3.1	2.04	0.44	0.06	0.005
2	4.08	.569	79.90	.05		3.77	.00		.017
3	3.65	.068	12.41	23.3	5.3	.50	.12	.03	.003
4	4.41	.377	13.85	16.5	3.9	2.31	.38	.09	.003
5	4.03	.332	138.00	41.0	3.0	2.22	.91	.07	.029
6	3.85	.988	188.00	48.3	6.3	6.93	3.35	.43	.043
7	4.25	1.080	34.80	39.6		6.86	2.72		.007
8	4.66	.852	490.95	43.5	4.0	4.94	2.15	.20	.091
9	4.41	.387	40.32	47.7	1.5	2.37	1.13	.04	.008
10	4.25	.227	23.41	38.8	5.5	1.44	.56	.08	.005
11	5.33	.736	36.28	39.7	2.0	3.73	1.48	.07	.006
12	5.08	.318	5.60	33.2	3.8	1.69	.56	.06	.001
13	4.91	.942	9.20	47.2	3.5	5.20	2.44	.18	.002
Average						3.39	1.26	.10	.017

TABLE 10. - Summary of channel-sampling results, tailing pile B, Miller Gulch

Channel No.	Vol. in place, cu. ft.	Conc. recovered, lb.	Gold recovered, mg.	Conc. analyses		Recovery per cu. yd.			
				Tin, percent	Cb_2O_5, percent	Conc., lb.	Tin, lb.	Cb_2O_5, lb.	Gold, oz.
14	4.00	0.053	16.04	7.6	4.1	0.36	0.03	0.01	0.004
15	3.58	.931	36.09	15.7	1.9	7.02	1.10	.13	.009
16	4.86	.215	31.44	28.8	3.1	1.19	.34	.04	.006
17	4.41	.164	143.23	31.6	4.5	1.00	.32	.05	.028
18	4.83	.176	134.78	27.0	2.9	.99	.27	.03	.024
19	3.75	.906	160.23	1.8	.2	.52	.12	.01	.036
20	3.08	.055	112.31	11.6	1.1	.48	.06	.01	.032
21	4.33	.087	21.93	10.0	3.5	.54	.05	.02	.004
22	6.08	1.006	318.39	3.0	.7	4.47	.13	.03	.055
23	4.91	.603	37.04	42.2	1.9	3.32	1.40	.07	.006
24	4.91	.171	70.03	24.6	6.0	.94	.23	.06	.014
25	5.33	.103	44.88	28.4	1.5	.52	.15	.01	.007
26	4.58	.079	82.81	4.0	7.0	.47	.02	.03	.016
27	3.50	.050	25.30	11.7	3.6	.38	.04	.01	.006
28	3.25	.117	17.48	29.7	3.1	.97	.29	.03	.005
29	3.00	.058	60.09	6.6	4.3	.52	.03	.02	.017
Average						1.88	.29	.03	.018

TABLE 11. - Summary of channel-sampling results, tailing pile C, Deep Creek

Channel No.	Vol. in place, cu. ft.	Conc. recovered, lb.	Gold recovered, mg.	Tin analyses, percent	Recovery per cu. yd.		
					Conc., lb.	Tin, lb.	Gold, oz.
30	1.95	0.273	29.00	27.2	3.78	1.03	0.013
31	2.25	.197	17.54	21.9	2.36	.52	.007
32	2.45	.680	86.32	37.1	7.49	2.78	.031
33	3.65	13.571	193.69	33.3	100.39	33.40	.046
34	2.55	.067	30.50	18.1	.71	.13	.010
35	2.85	.061	9.10	29.6	.58	.17	.003
36	3.35	.022	21.75	.4	.18	Tr.	.006
Average					21.07	6.96	.018

TABLE 12. - Summary of channel-sampling results, tailing pile D, Deep Creek

Channel No.	Vol. in place, cu. ft.	Conc. recovered, lb.	Gold recovered, mg.	Tin analyses, percent	Recovery per cu. yd.		
					Conc., lb.	Tin, lb.	Gold, oz.
37	3.00	0.167	5.05	48.6	1.50	0.73	0.002
38	2.95	.515	125.64	46.7	4.71	2.20	.037
39	3.00	1.626	89.94	51.4	14.63	7.52	.026
40	2.45	.516	60.30	52.6	5.69	2.99	.021
41	3.05	1.302	130.62	52.4	11.52	6.04	.037
42	3.35	.682	33.84	51.6	5.50	2.84	.009
43	3.55	.190	12.86	43.9	1.44	.63	.003
Average					6.32	3.22	.019

TABLE 13. - Summary of channel-sampling results, tailing pile E, Deep Creek

Channel No.	Vol. in place, cu. ft.	Conc. recovered, lb.	Gold recovered, mg.	Tin analyses, percent	Recovery per cu. yd. Conc. lb.	Tin, lb.	Gold, oz.
44	2.60	0.062	0	39.9	0.65	0.26	0
45	2.65	.015	-	.1	.15	Tr.	0
46	2.55	.055	0.42	.1	.59	Tr.	0.004
47	2.65	.016	0	.1	.16	Tr.	0
48	3.05	.022	0	.1	.20	Tr.	0
Average					.34	.05	.001

TABLE 14. - Summary of channel-sampling results, tailing pile F, Deep Creek

Channel No.	Vol. in place, cu. ft.	Conc. recovered, lb.	Gold recovered, mg.	Tin analyses, percent	Recovery per cu. yd. Conc., lb.	Tin, lb.	Gold, oz.
49	2.65	0.027	0	7.3	0.27	0.02	0
50	2.55	.046	15.31	.4	.48	Tr.	0.005
51	3.40	.110	76.98	7.8	.88	.07	.020
52	3.00	.093	16.26	6.9	.84	.06	.005
53	3.25	.164	3.49	4.9	1.36	.07	.001
54	3.30	.053	3.45	5.5	.44	.02	.001
55	2.63	.015	0	.4	.15	Tr.	0
56	1.95	.015	0	.2	.21	do.	0
Average					.62	.03	.004

TABLE 15. - Summary of channel-sampling results, tailing pile G, Idaho Gulch

Channel No.	Vol. in place, cu. ft.	Conc. recovered, lb.	Gold recovered, mg.	Tin analyses, percent	Recovery per cu. yd. Conc., lb.	Tin, lb.	Gold, oz.
57	1.52	0.100	49.34	34.4	1.77	0.61	0.028
58	1.70	.027	2.04	22.0	.43	.10	.001
59	1.90	.028	125.29	22.9	.40	.09	.057
60	1.90	.446	20.84	55.6	.63	.35	.010
61	2.00	.693	14.29	38.1	9.36	3.56	.006
Average					2.67	1.00	.020

TABLE 16. - Summary of channel-sampling results, tailing pile H, Woodchopper Creek

Channel No.	Vol. in place, cu. ft.	Conc. recovered, lb.	Gold recovered, mg.	Tin analyses, percent	Recovery per cu. yd. Conc., lb.	Tin, lb.	Gold, oz.
62	2.40	0.026	92.64	15.8	0.29	0.05	0.034
63	3.38	.104	281.02	42.1	.83	.35	.072
64	3.30	.078	300.58	35.4	.64	.23	.067
65	3.88	.090	208.02	21.1	.63	.13	.047
66	3.20	.027	201.08	5.5	.20	.01	.055
67	3.20	.029	88.64	18.1	.24	.44	.024
68	2.85	.148	52.37	12.7	1.40	.18	.016
69	2.35	.016	59.06	3.0	.18	.01	.022
70	2.85	.511	138.77	50.4	4.84	2.44	.042
71	3.80	.031	172.78	23.7	.22	.05	.040
72	2.90	.022	117.92	8.8	.21	.02	.035
73	2.90	1.035	262.33	53.9	9.64	5.19	.079
Average					1.54	.72	.045

TABLE 17. - Summary of channel-sampling results, tailing pile I, Dalton Gulch

Channel No.	Vol. in place, cu. ft.	Conc. recovered, lb.	Gold recovered, mg.	Tin analyses, percent	Recovery per cu. yd.		
					Conc., lb.	Tin, lb.	Gold, oz.
74	2.50	1.266	0	56.8	13.67	7.77	0
75	2.00	.024	31.41	19.6	.33	.06	0.014
76	2.45	2.964	2.64	29.7	32.66	9.70	.001
77	2.45	.178	0	42.3	1.97	.83	0
78	2.40	.061	153.33	41.4	.69	.29	.056
Average					10.28	3.90	.014

TABLE 18. - Summary of channel-sampling results, tailing pile J, Cache Creek

Channel No.	Vol. in place, cu. ft.	Conc. recovered, lb.	Gold recovered, mg.	Tin analyses, percent	Recovery per cu. yd.		
					Conc., lb.	Tin, lb.	Gold, oz.
79	2.90	0.032	21.97	38.4	0.30	0.12	0.007
80	2.70	.145	7.31	37.1	1.45	.54	.002
81	2.45	1.401	273.39	55.7	15.44	8.60	.097
82	2.85	.148	15.46	43.9	1.40	.61	.005
Average					4.27	2.26	.025

TABLE 19. - Summary of channel-sampling results, tailing pile K, Harter Gulch

Channel No.	Vol. in place, cu. ft.	Conc. recovered, lb.	Gold recovered, mg.	Tin analyses, percent	Recovery per cu. yd.		
					Conc., lb.	Tin, lb.	Gold, oz.
83	2.35	0.093	35.43	37.1	1.07	0.40	0.013
84	2.75	.034	9.24	15.2	.33	.05	.003
85	3.00	.104	0	35.8	.93	.33	0
86	2.65	.105	168.21	30.1	1.07	.32	.055
Average					.84	.27	.017

Mine Examinations

The Larsen drift mine on Deep Creek (Fig. 6) was the only underground mining operation in the district that was active during the Bureau of Mines investigation. The mine was examined by the Bureau engineer. Because of the similarity to many of the early-day operations, the development and mining procedures employed at the Larsen diggings are described briefly as follows:

The shaft was on a 6-inch churn-drill hole that had logged pay in placer gold. A 3/8-inch open-end pipe or steam "sweater" was inserted to the bottom of the hole, which had previously been drilled several feet into bedrock. Steam at 100 p.s.i. boiler pressure was forced through the sweater to the bottom of the hole for a continuous period of approximately 4-1/2 days; the time for completing the thawing was estimated on a thawing rate of approximately 1 hour per foot of muck and 45 minutes per foot of gravel. When excavated, the shaft was 119 feet in depth and 6 feet in diameter. The collar of the shaft was timbered, and the top 17 feet was cribbed; frost prevented caving below the cribbing.

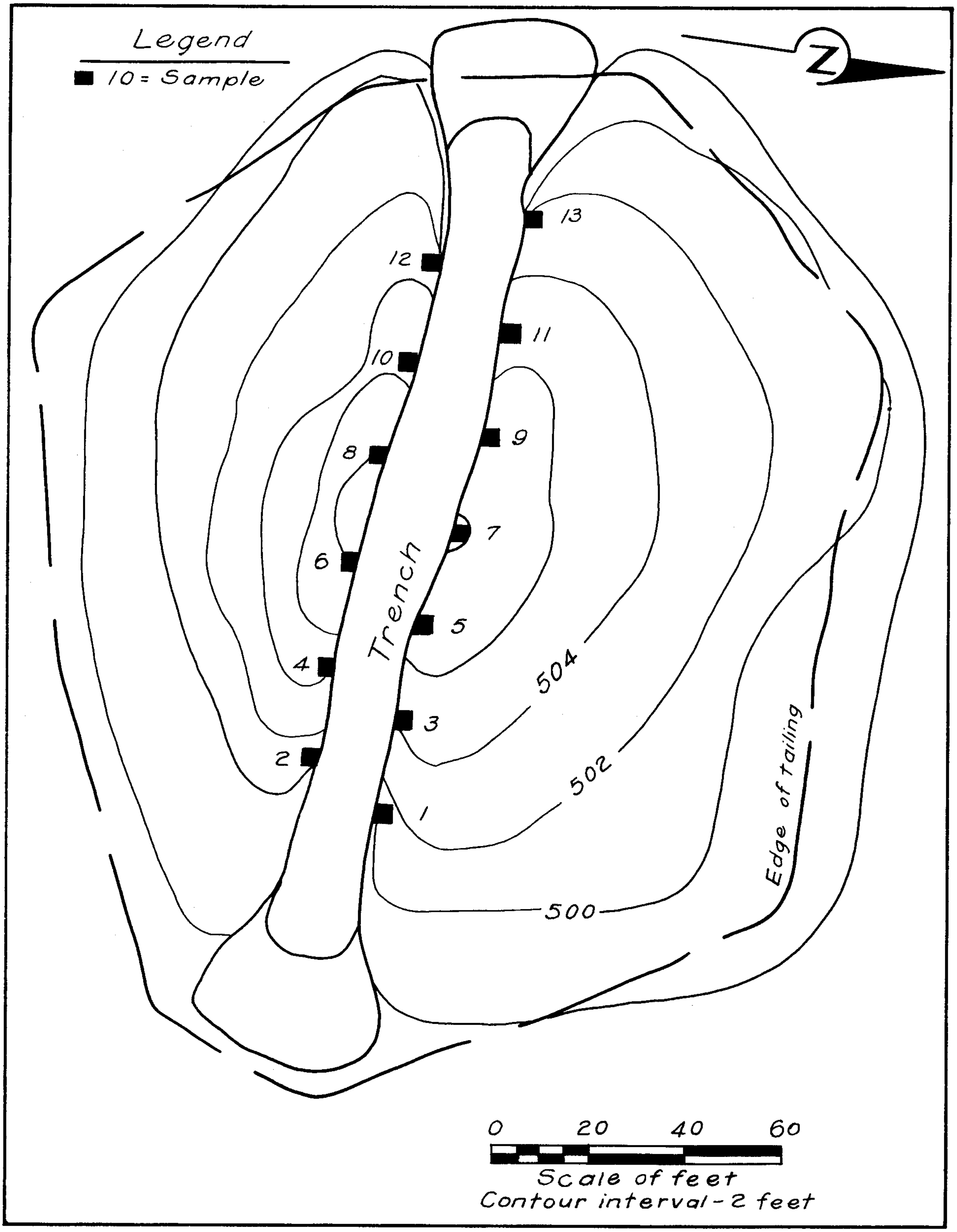

Figure 34. - Sample and topographic map, tailing pile A.

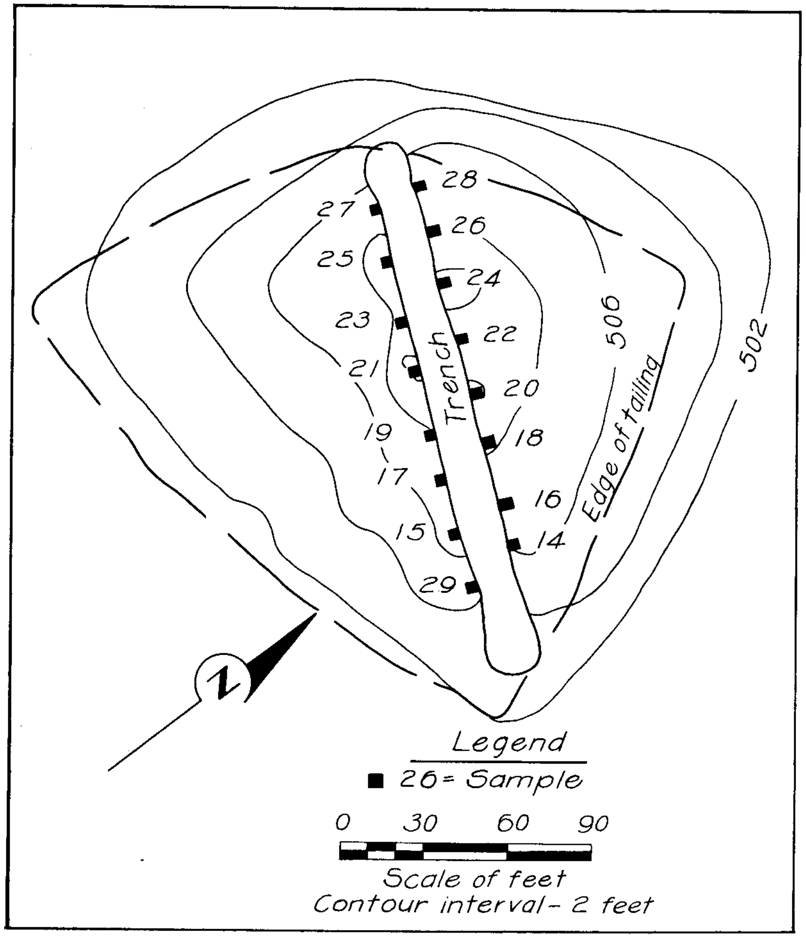

Figure 35. - Sample and topographic map, tailing pile B.

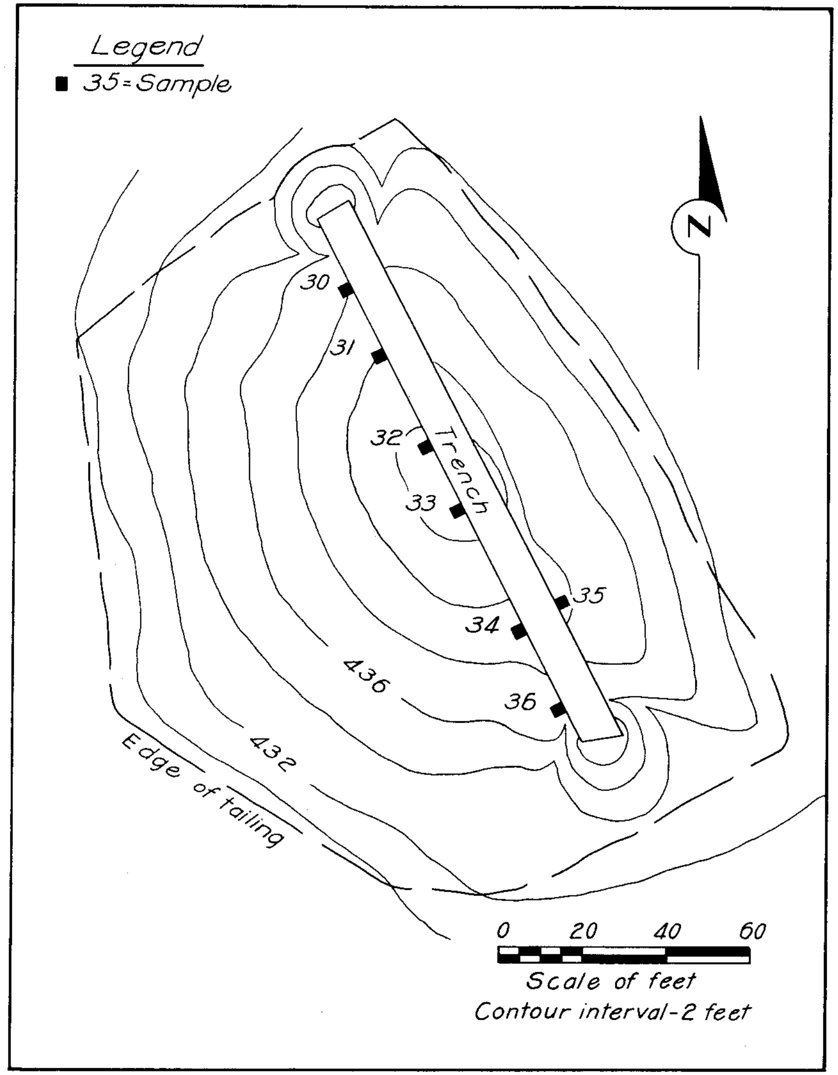

Figure 36. - Sample and topographic map, tailing pile C.

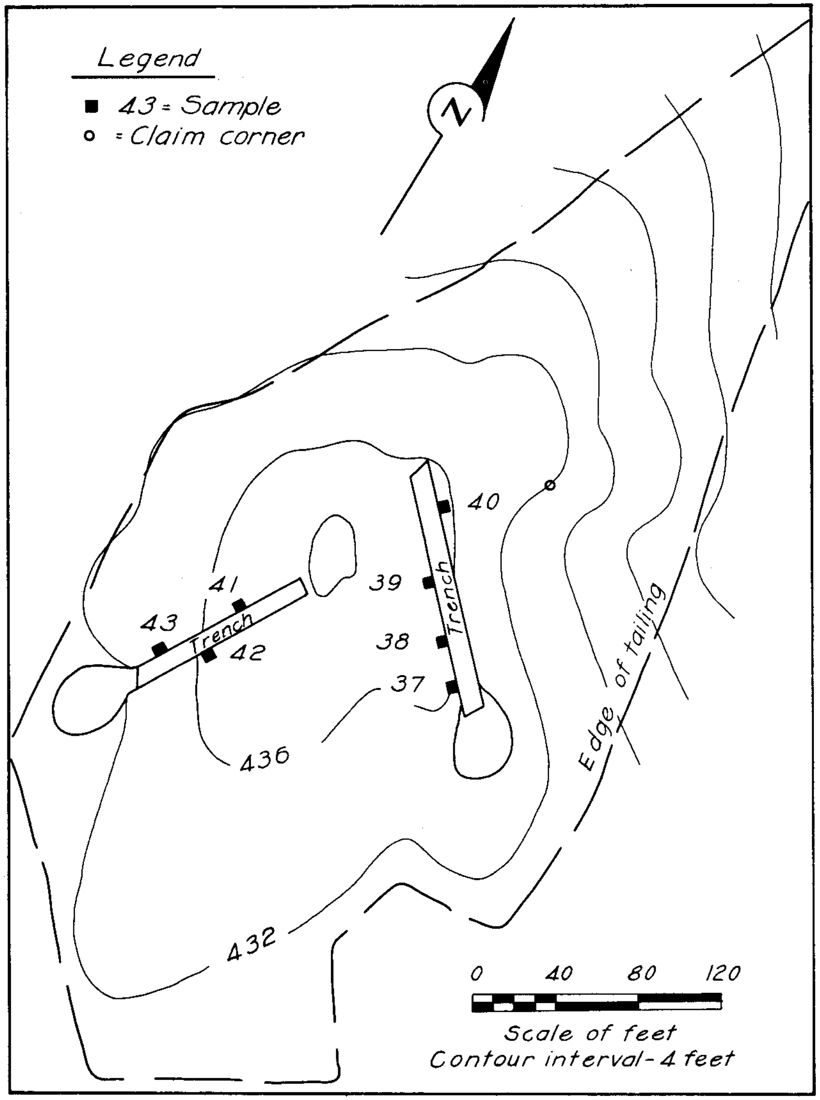

Figure 37. - Sample and topographic map, tailing pile D.

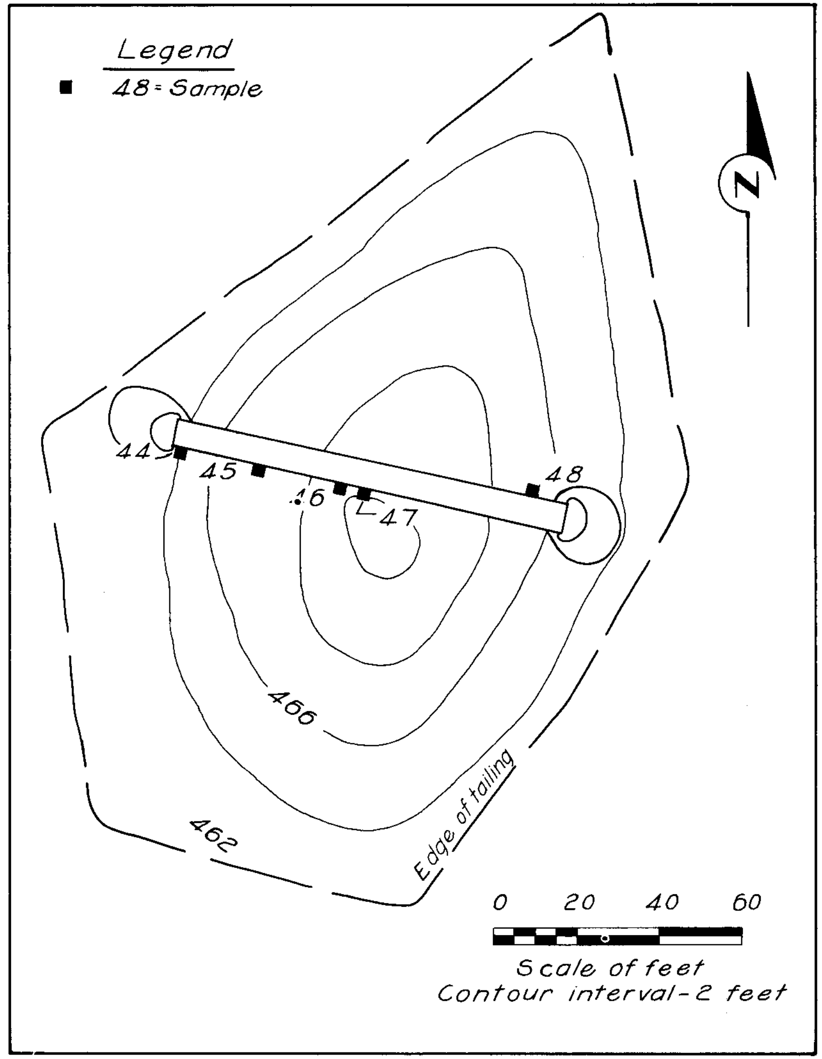

Figure 38. - Sample and topographic map, tailing pile E.

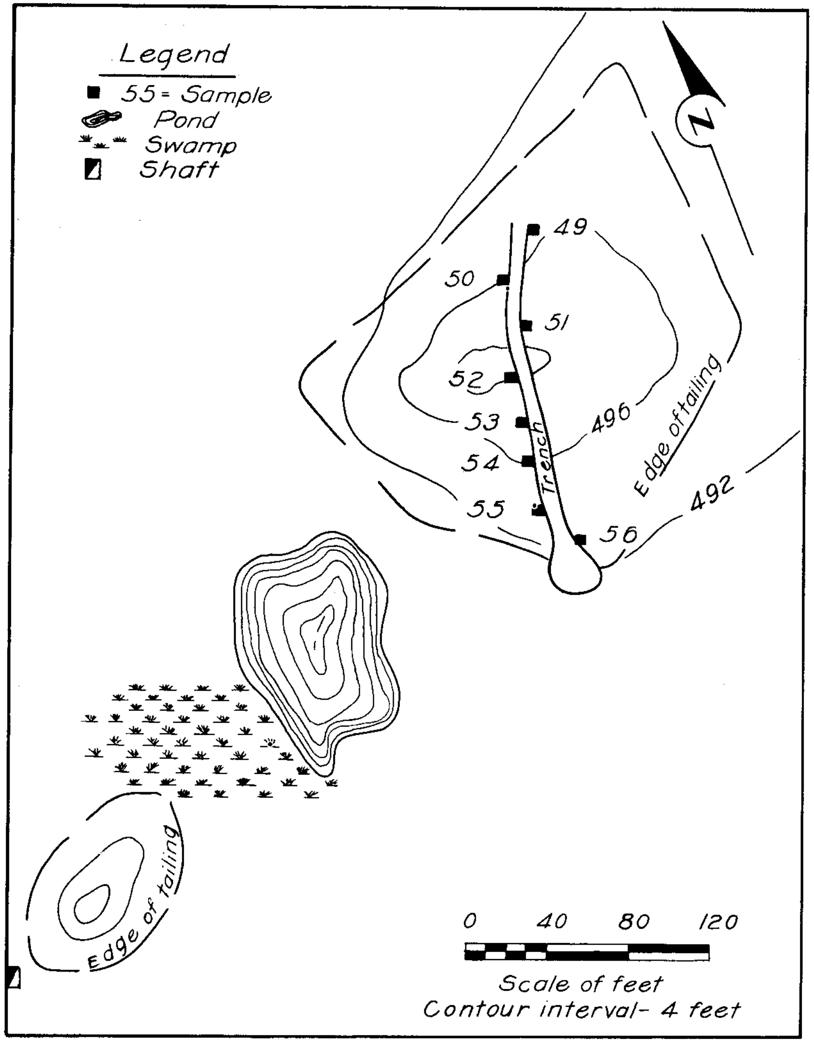

Figure 39. - Sample and topographic map, tailing pile F.

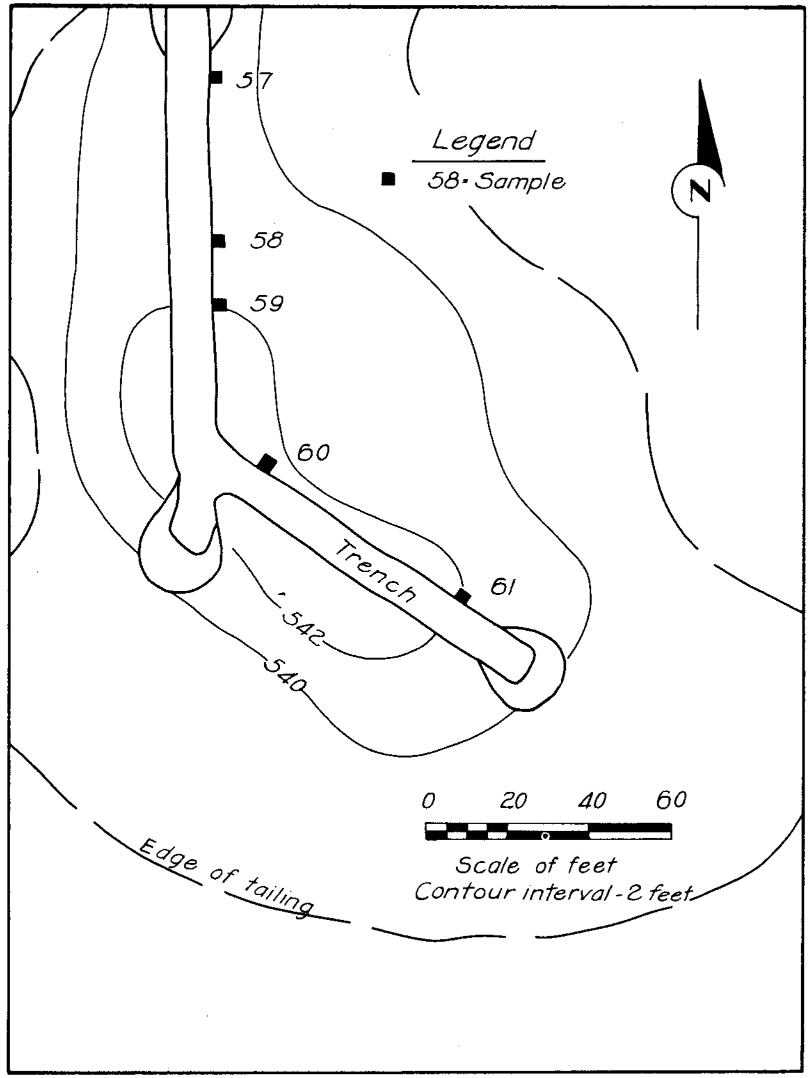

Figure 40. - Sample and topographic map, tailing pile G.

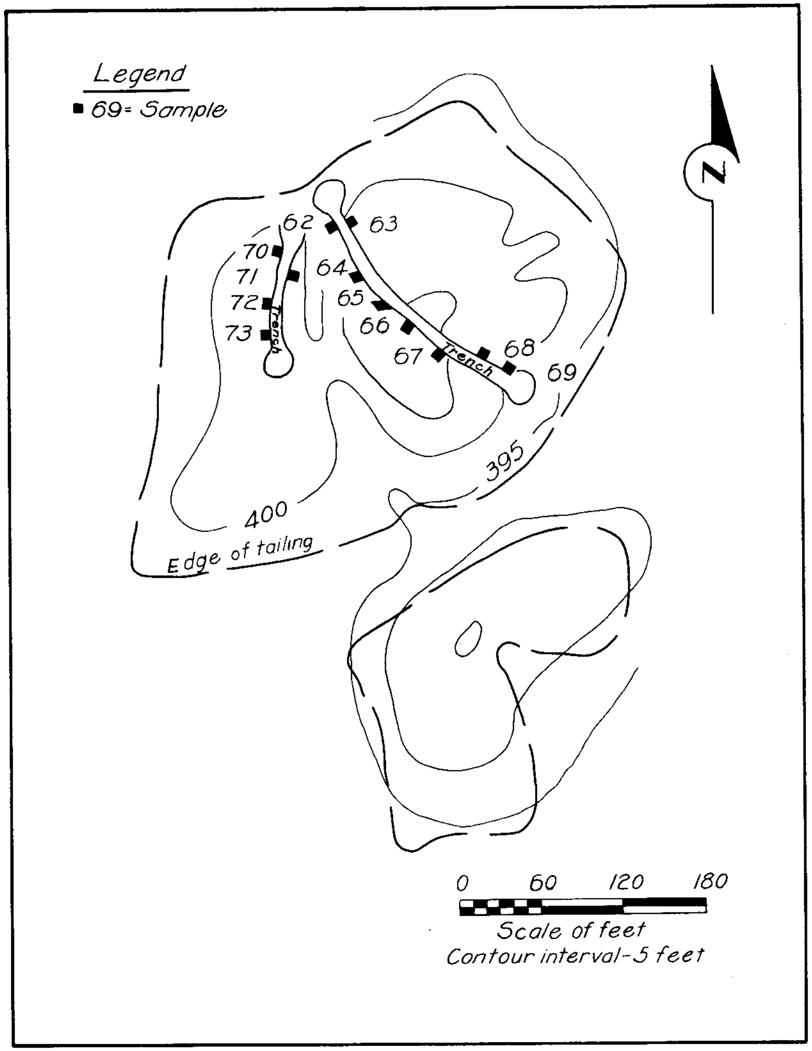

Figure 41. - Sample and topographic map, tailing pile H.

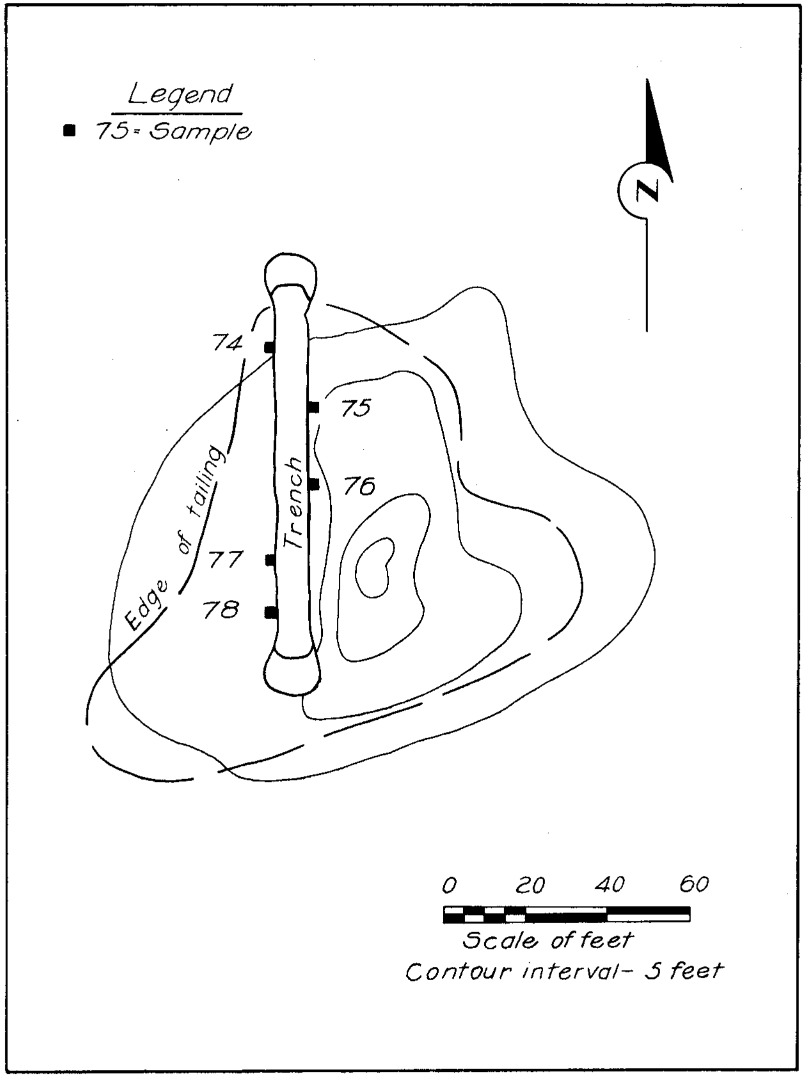

Figure 42. - Sample and topographic map, tailing pile I.

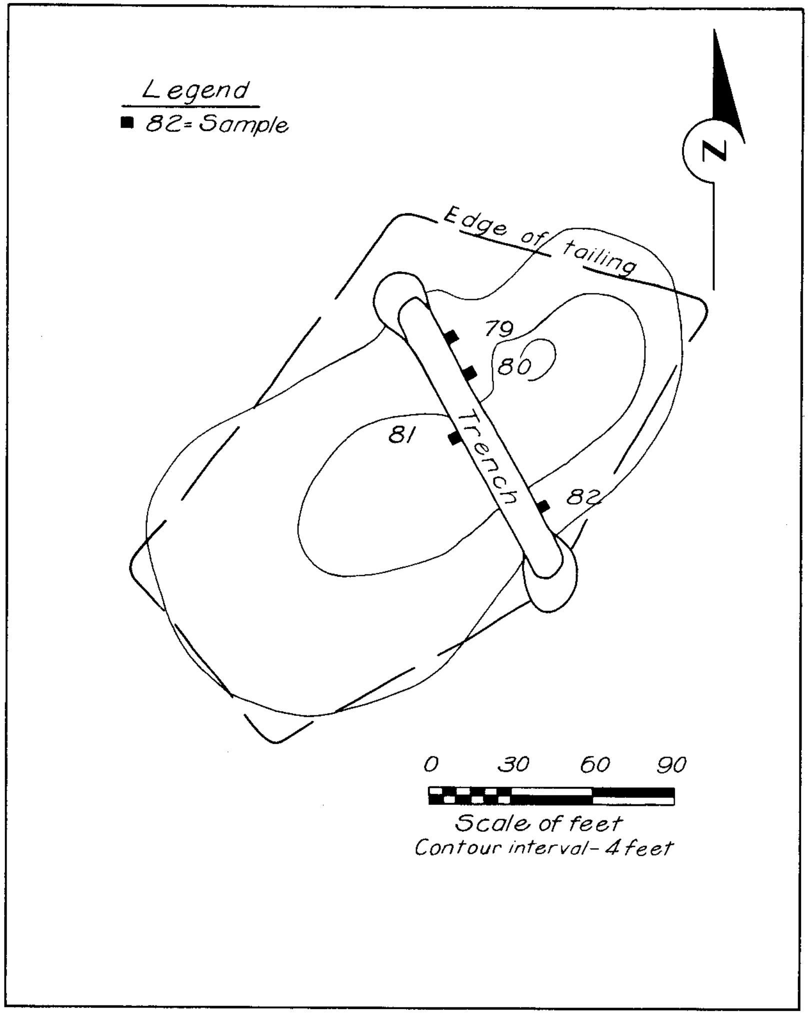

Figure 43. - Sample and topographic map, tailing pile J.

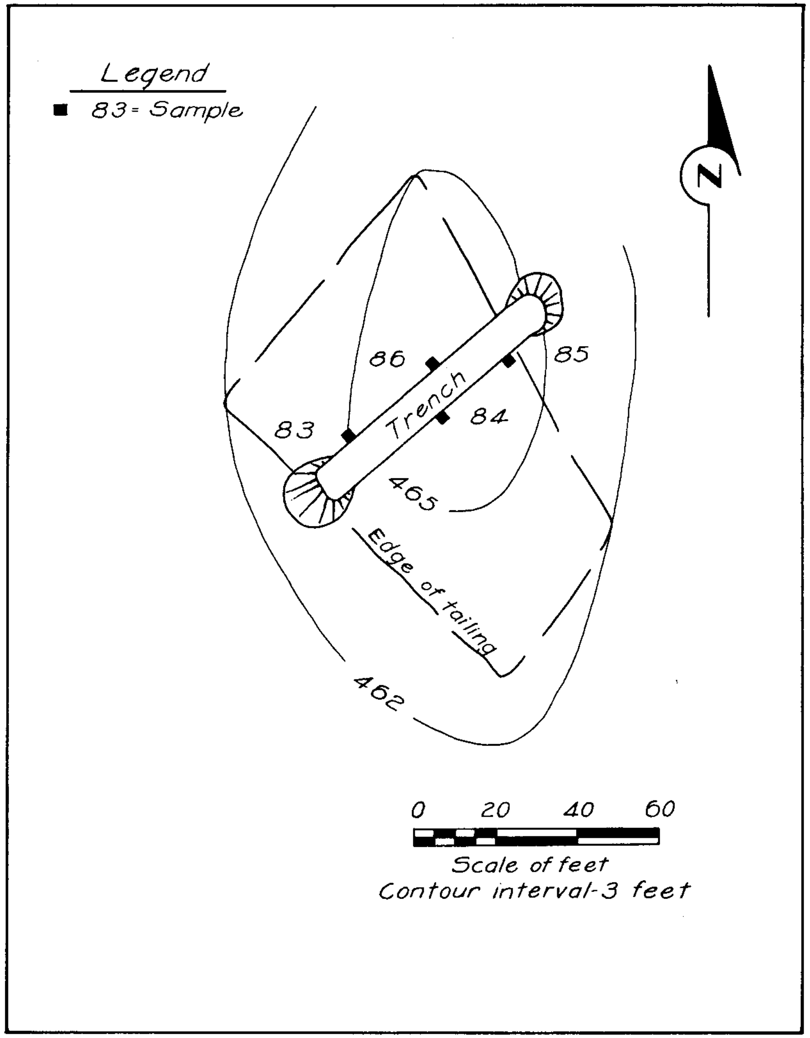

Figure 44. - Sample and topographic map, tailing pile K.

Mining is done by an advancing room-and-pillar system; very little timber is used. Wherever possible, mining is advanced up the slope of the bedrock, so that natural drainage is toward the shaft sump. The gravel is thawed by driving steam points and "sweaters" into the face. At this particular location about 3-1/2 feet of gravel and bedrock is excavated and hoisted to the surface. Barren gravel sloughs from the back and is shoveled into mined-out areas; as thawing continues, enough barren gravel sloughs from the back to provide 5 to 6 feet of headroom near the face. A 22-hp., wood-fired boiler provides steam for thawing and hoisting during mining and for pumping and elevating during washing.

A graphic section showing the thickness and types of material penetrated by the Larsen shaft is given in figure 45.

Tin Reserves

Although the Bureau of Mines investigation was neither planned nor executed to "block out" reserves, the tin production potential of the Tofty tin belt is indicated roughly by the churn-drill prospecting information submitted by private operators, by geologic inference, and by the data obtained from the tailing-sampling program.

Firm estimates of reserves of tin in place (in unmined parts of the various pay channels) cannot be made because the available information does not contain data necessary for such calculations. Former mining and prospecting in the district were concerned with gold only; consequently little or no attention was given to determining the tin content of the placer gravels. However, the volume of gravel contained in unmined sections of placer deposits along Tofty and Idaho Gulches and along Sullivan Creek may be approximated from prospect-drill data, as given in tables 5 and 6 and as illustrated by figures 15 through 32. Geologic evidence indicates that unmined tin-bearing placer deposits of equal or greater volume than those mentioned above exist in the Deep Creek-Woodchopper Creek areas (fig. 3); further prospecting may greatly extend the limits of the tin-bearing placers as now known.

The tin content of the unmined gravels in the various areas throughout the length of the belt may be roughly approximated from tailing samples taken from wash dumps in those areas. The tin content of such samples ranged from an average of 0.24 pound per cubic yard of tailing in the Sullivan Creek open pit (as determined by Thorne and Wright[7/]) to as much as an average of 2.77 pounds per cubic yard of tailings in 4 drift mine dumps on Deep Creek (figs. 11-14, inclusive).

The tailing piles sampled were selected as being fairly representative of all the tailing in a particular area and therefore are considered to be roughly representative of the tin content of unsampled piles in that area. By transit surveys, visual estimates, and aerial surveys (including aerial photographs), the ratio of the volume of tailing sampled to the total volume of tailing available for re-treatment can be determined within reasonable limits of accuracy. Applying such a factor, it is estimated that drift-mine and opencut tailing throughout the length of the tin belt constitute an "inferred" reserve of 733,000 pounds of tin contained in 1,259,000 cubic yards of gravel; the tailings may also contain as much as 17,700 ounces of gold, as well as small amounts of columbium-tantalum oxides.

The tailings are fairly accessible, and the cassiterite and other heavy minerals can be recovered by conventional gravity methods of separation. Because of the comparatively small size of the individual dumps, a highly portable washing plant would be an important factor in economic recovery of the heavy minerals.

7/ Work cited in footnote 2, p. 4.

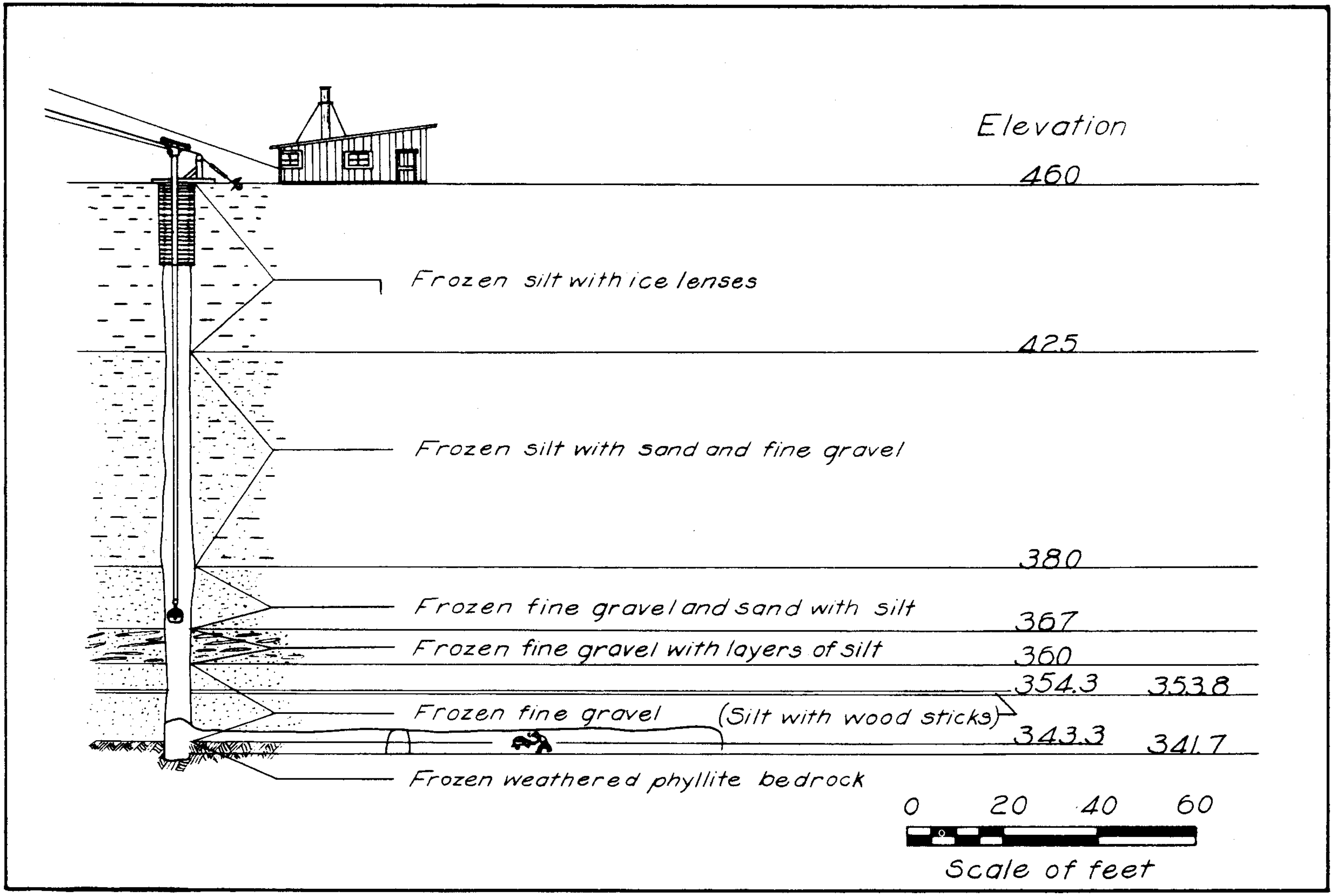

Figure 45. - Cross section through Larsen shaft, Deep Creek.

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