UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

PLACER TIN DEPOSITS IN CENTRAL ALASKA

By

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Open-file report

1963

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SOME PLACER TIN DEPOSITS IN CENTRAL ALASKA

By Robert M. Chapman, Robert R. Coats, and Thomas G. Payne

ABSTRACT

Placer tin, in the form of cassiterite (SnO_2) and (or) tinstone (fragments including cassiterite and some vein or rock material), is known or reported in deposits that have been prospected or mined for placer gold in four areas adjacent to the Yukon River in central Alaska, 120 to 240 miles west of Fairbanks. These areas are: the Morelock Creek area, on the north side of the Yukon River about 30 miles upstream from Tanana; the Moran Dome area, about 16 miles north of the Yukon River and 25 miles northwest of Tanana; the Mason Creek area, on the north side of the Yukon River about 36 miles west of Tanana; and the Ruby-Long area, on the south side of the Yukon River near Ruby and about 40 miles east of Galena. The only extensive placer mining in these areas has been in the Ruby-Long area. Other placer deposits including some cassiterite are known in central Alaska but are not discussed in this report.

Bedrock in these areas is predominantly schist of various types with some associated greenstone and other metamorphic rocks. Some granite is exposed in the Moran Dome and Ruby-Long areas and in areas close to Morelock and Mason Creeks. Barren, milky quartz veins and veinlets transecting the metamorphic rocks are common. No cassiterite was found in the bedrock, and no bedrock source of the tin has been reported. In the Moran Dome and Mason Creek areas, and in part of the Ruby-Long area, tourmaline is present in the rocks of the tin-bearing drainage basins, and apparently absent elsewhere in these areas.

The placer deposits are in both valley floor and bench alluvium, which are predominantly relatively thin, rarely exceeding a thickness of 30 feet. Most of the alluvium deposits are not perennially frozen.

In the Morelock Creek area tin-bearing deposits are 5 to 5½ miles above the mouth of the creek, and meager evidence indicates that cassiterite and gold are present in Morelock Creek valley and some of the tributaries both upstream and downstream from these deposits. The concentrates recovered in samples average about 57 percent tin, and the gold averages about 922 fine. Prospecting indicates that the placer tin deposits are small and of relatively low grade, and that the greater part of the value of the deposits is the gold.

In the Moran Dome area the known tin-bearing deposits are in the valley floor and bench gravels along upper Tozimoran Creek. Much of the alluvium is unfrozen, but the deeper portions of the bench gravels and the gravels some distance from the streams are in part frozen. Tin-bearing samples have been obtained from prospect pits and drill holes at a number of sites on Tozimoran Creek between its head and the confluence with Slate Creek. Gold recovered from some of these samples has a fineness of 835. The presence of cassiterite and gold on Ash Creek has been confirmed by sampling. Cassiterite and gold reportedly occur on upper Melozimoran Creek, and several other stream valleys in this area may be tin bearing.

In the Mason Creek area cassiterite has been reported in the valley floor and bench alluvial deposits on Mason Creek, but its presence could not be confirmed in the brief field examinations of creek and dump-pile gravel that were made. The limited number of pits and cuts available precluded a valid sampling without additional drilling, pitting, or trenching.

In the Ruby-Long area the valleys of Midnight, Birch, and Big Creeks are known to have appreciable concentrations of cassiterite in the gold-bearing placer deposits. The alluvial deposits in the valleys of Ruby, Glacier, Flint, Trail, Long, Fifth of July, Short, Flat, Greenstone, and Monument Creeks contain some cassiterite, but sufficient information could not be obtained to make an evaluation of these occurrences. Cassiterite concentrates, reportedly ranging from 52 to 70.24 percent tin, have been recovered in connection with gold mining operations on Midnight, Birch, and Big Creeks.

INTRODUCTION

During the summer of 1942 the U.S. Geological Survey examined three areas of tin-bearing placer deposits in central Alaska: Morelock Creek, the Moran Dome area, and the Ruby-Long area (fig. 1). Additional examinations were made in the Morelock Creek and Moran Dome (Tozimoran and Melozimoran Creeks) areas in 1943, and in 1944 the Mason Creek area was briefly examined (fig. 1).

The purpose of these investigations was to provide an evaluation of the placer tin deposits for possible wartime use. Owing to wartime regulations, the three reports by Payne, Coats, and Chapman, respectively, covering the initial work in the first three areas could not be released for public inspection. Under a post-war ruling of the Geological Survey, however, the information contained in these reports has been declassified and is presented herein.

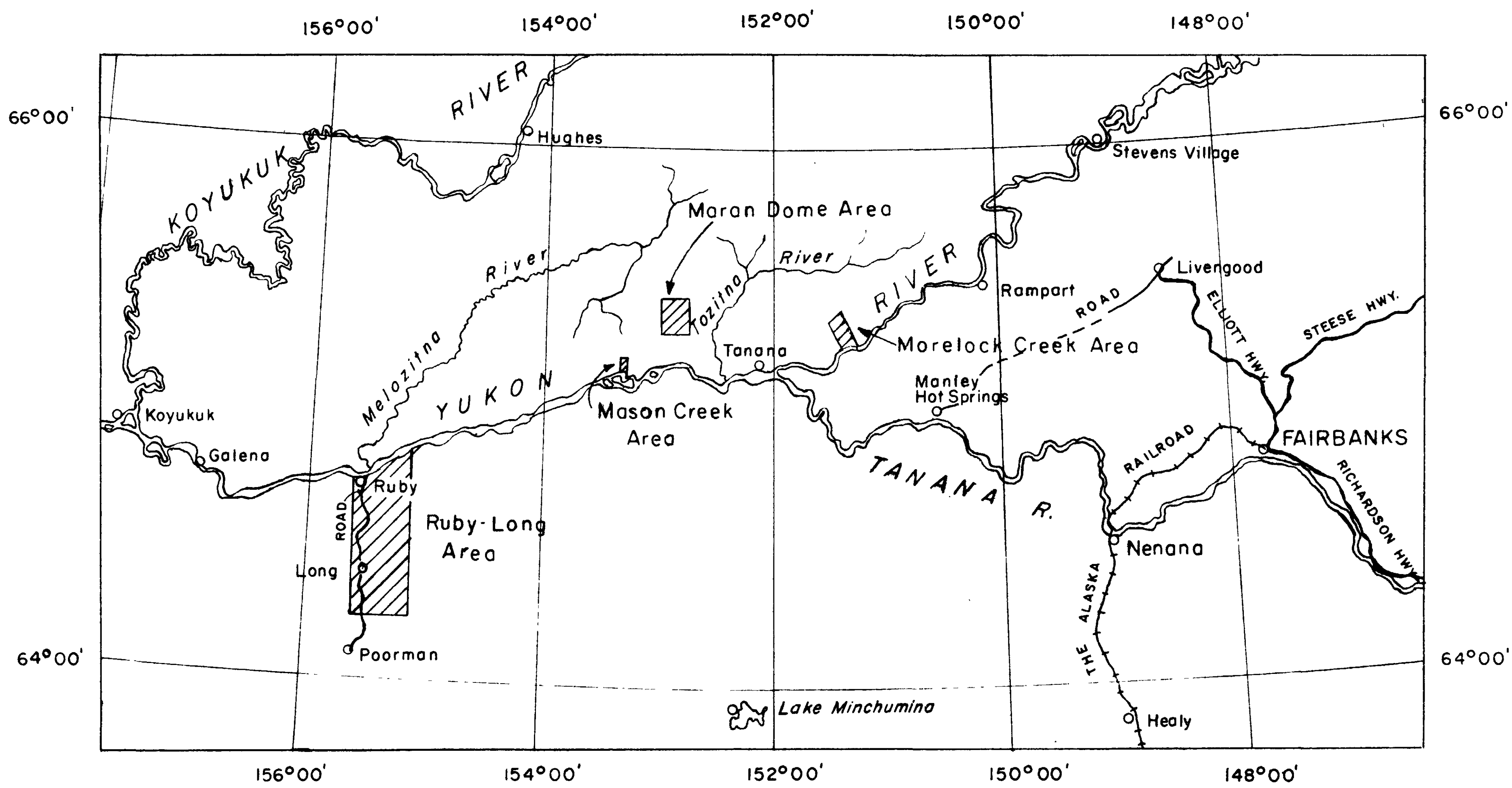


FIGURE I - INDEX MAP OF PART OF CENTRAL ALASKA
SHOWING LOCATIONS OF PLACER TIN AREAS

1:2 500 000

10 0 10 20 30 40 50 60 70 MILES

In the summer of 1952 Tozimoran Creek was drilled and trenched under a Defense Minerals Exploration Administration contract. Also, between 1946 and 1956 several geological investigations for other purposes were made in the Moran Dome and Ruby-Long areas by the Geological Survey.

The original authors' reports on the 1942 work have been used, and pertinent additional information gathered between 1943 and 1956 and minor revisions have been incorporated by Robert M. Chapman. Other placer tin deposits in central and interior Alaska are not mentioned in this report, and the reader is referred to a map showing tin occurrences in Alaska (Cobb, 1960) for further information.

The present geological knowledge of these areas and their placer deposits is incomplete and inadequate on certain points, but the information gathered from the geological work and sampling in these four placer tin areas supports the view that no economic significance should be attached to the placer tin deposits under present economic conditions. The distribution and geological implications of these deposits are, however, pertinent to an interpretation of the geologic history of the mineralization in interior Alaska.

Most of the placer tin deposits in these areas are in close proximity, 8 miles or less, to exposed granite or granitic intrusives or the contact zones of these bodies. It may be assumed as a reasonable working hypothesis that granitic intrusives at shallow depth beneath other bedrock, or perhaps masked by a heavy cover of unconsolidated deposits, are relatively close to the placer tin-bearing deposits in areas such as Big, Glacier, and Ruby Creeks near Ruby, where no granitic rocks are known. Mertie and Harrington (1924, p. 117-118, 120-123) point out the relation between cassiterite deposits and granitic rocks in the Ruby-Kuskokwim region, and present a general hypothesis for the origin of the gold and related minerals such as cassiterite. On the basis of the examinations of the four placer tin areas discussed in this report, little can be added to the hypothesis advanced by Mertie and Harrington except to suggest that the geologic settings of the Morelock Creek, Moran Dome, and Mason Creek areas appear to be similar to that of the tin-bearing parts of the Ruby-Long area. Study of the granitic rocks adjacent to these three areas and a detailed examination of the mineral assemblage in the placer deposits should yield information that would help the geologist decipher the history of igneous rock emplacement and related mineralization in central Alaska.

PLACER TIN AND GOLD DEPOSITS IN THE MORELOCK CREEK AREA

By Thomas G. Payne and Robert M. Chapman

INTRODUCTION

Morelock Creek, a southeastward-flowing stream about 13 miles long, empties into the Yukon River on the north side, at a point approximately 27 river miles upstream from Tanana. The area of known placer tin deposits is in the valley of Morelock Creek 5 to 5½ miles above its mouth and in the lower part of the tributary valley of Bonanza Creek (figs. 2 and 3). Cassiterite may be present for a distance of 1½ miles along Morelock Creek.

J. B. Mertie, Jr. (1934, p. 192), reports receiving from Mr. Joe Egler of Rampart a sample of the concentrates from Bonanza Creek containing magnetite, cassiterite, and ilmenite. Bonanza Creek, a tributary of Morelock Creek, was apparently erroneously reported as a tributary of Bear Creek, which is tributary to the Yukon River about 10 miles northeast of Morelock Creek.

The late Mr. Edward Vogt resided on Morelock Creek in 1942 and 1943, and held the claims on which the tin occurs. Vogt and several other prospectors, including John Irving, opened about 70 prospect holes and 6 small cuts in the tin- and gold-bearing area by 1943 but did no mining other than from the cuts. Vogt, having in mind the possibility of future mining in the area, cleared a tractor trail through most of the stretch between the Yukon River and the tin area. Freight can be brought from Nenana, on the Alaska Railroad, by riverboat via the Tanana and Yukon Rivers, and landed at the mouth of Morelock Creek.

This report is based primarily on field work that was done between August 16 and September 11, 1942, by Thomas G. Payne, assisted by William N. Laval, field assistant, Fred G. Rich, camp hand, and Robert W. Hackleman, cook. Additional field work in this area was done between June 25 and July 30, 1943, by Robert M. Chapman, assisted by Donald E. Mathewson, field assistant. The objectives of this work were to extend geologic study where necessary, to search for indications of a lode source of cassiterite, and to cooperate on geological problems with the U.S. Bureau of Mines test-drilling party. The information gathered in this work has been incorporated by Chapman into Payne's original report. The field work was done under the general supervision of Robert R. Coats, who was in charge of Geological Survey field work in the central part of Alaska. The hospitality and cooperation of Mr. Edward Vogt were very helpful to the field parties. The assistance and hospitality of Messrs. Bruce I. Thomas, Harold C. Pierce, and other members of the U.S. Bureau of Mines party in 1943 are gratefully acknowledged.

GEOLOGY

Bedrock

The bedrock in the Morelock Creek area consists of metamorphic rocks including massive greenstone, greenstone schist, metachert, massive quartzite, light- to dark-gray limestone, recrystallized cherty dolomite, marble, phyllite, calcareous schist, quartz-mica schist, quartzite schist, and several varieties of micaceous schist. The rock units are so thin and numerous and are so complexly folded and faulted that geologic mapping is difficult, and no logical basis was found for grouping them into broader mappable units. Because of this complexity and the fact that detailed subdivision of the bedrock does not have an important bearing on the placer tin deposits, all the rocks of the area are designated on the map (fig. 2) as undifferentiated metamorphic rocks. The rocks of the Morelock Creek area are similar to those in the adjacent Yukon-Tanana region described by Mertie (1937); they probably belong mostly in the category designated by Mertie as undifferentiated Mississippian rocks, but it is believed that some Upper Devonian rocks also are represented. More recently Dutro and Payne (1957) mapped these rocks as part of a gross unit, designated as Paleozoic metamorphic rocks undifferentiated, that includes predominantly pre-Devonian rocks but may include some Precambrian and Mesozoic rocks.

Tertiary granitic rocks crop out in adjacent parts of the Yukon-Tanana region and in the area a few miles northeast of Morelock Creek (Dutro and Payne, 1957) but were not found in the tin-bearing portion of the Morelock Creek drainage area. A reconnaissance study of the rocks in the Bonanza Creek drainage showed that granitic rocks are not present as mapped by Eakin (1916, Pl. 2). No tin-bearing veins from which the cassiterite of the placer deposits might have been derived were seen, but a study of the tin-bearing pebbles from the placer deposits indicates that they were derived from cassiterite-bearing quartz veins. No metallic minerals were seen in the numerous veins of milky quartz in the metamorphic rocks, although minute pits stained and encrusted with limonite, presumably residual relics of weathered pyrite crystals, were noted in quartz veins on the ridges on both sides of Bonanza Creek.

The bedrock in the vicinity of the placer-tin deposits, including greenstone, quartz-mica schist, dark micaceous schist, and recrystallized cherty dolomite, is largely covered by alluvium. These rocks strike across the valley of Morelock Creek in a northeasterly direction and crop out in the creek banks. Bedrock is also visible in prospect holes and cuts. In the open cut designated cut 7 on figure 3, the contact between a bed of massive greenstone and a bed of quartz-mica schist dips downstream (southeastward) at an angle of 70°-75° and strikes approximately N. 55° E. A contact, along which a quartz vein is intruded, between greenstone and light-gray calcareous schist was observed in 1943 near the western end of the ridge top between Maggie Creek and the next tributary to the northwest. This contact strikes about N. 55° E. and dips 30°-35° SE. Elsewhere in the tin area contacts between beds are covered and original stratification of the beds cannot be seen. The strike of the schistosity ranges approximately from N. 3° E. to N. 2° W., although variations from N. 5° W. to N. 25° E. were observed, and the dip ranges from 60°-70° E.

The bedrock exposed along the streams and on the slopes and ridges of Bonanza, Homestake, Maggie, and upper Morelock Creeks was examined particularly in 1943 in an attempt to locate a source of the cassiterite or any evidence of mineralization that might have been associated with the tin. None was found. Schist of various types and greenstone, all containing some veins, lenses, and stringers of barren quartz, occur in the Homestake Creek drainage. The Bonanza Creek drainage area includes some limestone and dolomite, cherty in parts, in addition to the aforementioned rock types, and milky quartz seems to be more abundant than in the Homestake and Maggie Creeks valleys. The rocks on the ridge on the north side of Maggie Creek include all of the previously mentioned types, and also a minor amount of calcite in veins and pods. Outcrops and float along Morelock Creek for a distance of at least 2 miles upstream from Maggie Creek showed only schist with a minor amount of barren quartz. Scattered minute crystals of pyrite, or their limonitic weathered equivalent, are ubiquitous in all of the rock types, and are found in some of the quartz.

The repetition of beds in the tin area suggests the presence of a fault. From the mouth of Bonanza Creek down Morelock Creek to the upper end of cut 7 (fig. 3) the succession of beds is (a) greenstone, (b) quartz-mica schist, (c) dark micaceous schist, (d) greenstone, and (e) recrystallized cherty dolomite. From the upper end of cut 7 downstream to the eastern margin of the mapped area (fig. 3), the first three members of the aforementioned succession occur in the same order, and farther downstream in bluffs on both sides of Morelock valley the last two members of the succession were noted, the cherty dolomite (e) being represented by metachert in a bluff about 200 feet down the valley from Vogt's cabin (fig. 2), which is on the northeast side of Morelock Creek about 4,000 feet below the mouth of Bonanza Creek. The fault is believed to cross the valley in a zone passing through the vicinity of prospect hole 19 (fig. 3), in which the bedrock is a mixture of shattered cherty dolomite and greenstone. There is evidence that the fault has caused considerable displacement of rocks in the area, but it does not seem to be related to any metallization.

Alluvium

The alluvial material of the tin area is gravel, which ranges from 5 to 6 feet in thickness, overlain by 2 to 3 feet of silt, some of which contains vegetal material. The silt is covered by a dense mat of surface vegetation. The unconsolidated deposits average only about 8 feet in thickness. Locally, the gravel thickens to 20 feet, and at one prospect hole thins to less than 2 feet. On the creek flat the silt (muck) commonly is less than 2 feet thick; on the benches, however, locally it is more than 8 feet thick. The gravel of the creek flat is coarse and contains an abundance of boulders, some as large as 18 inches in mean diameter, though most of the larger material is only of cobble size.

PLACER DEPOSITS

The placer tin and gold of the Morelock Creek area are localized largely in a few inches of gravel at the base of the unconsolidated deposits, on the irregular surface of the bedrock, and in crevices in the upper few inches of bedrock. As the schistosity dips steeply and the rocks are highly jointed, weathering and erosion have produced a bedrock surface that is jagged and highly creviced, forming large natural riffles, a condition that is ideal for trapping the heavy constituents of the gravel. Possibly the cassiterite, gold, and other heavy minerals are largely localized upon the resistant bedrock ridges in the valley bottom (Thomas and Wright, 1948a, p. 4), but not enough exploration has been done to definitely establish this theory.

Samples of six concentrates from different parts of the area shown on figure 3 were analyzed for tin in 1942-43 by J. G. Fairchild of the Chemical Laboratory, U.S. Geological Survey. The analyses indicate that the tin content ranges from 47.3 to 65.2 percent and averages about 57 percent. After removal of the gold, the concentrates contain (by weight) 70 to 75 percent cassiterite, 10 to 15 percent magnetite, 3 to 4 percent ilmenite, and 10 to 15 percent hematite, garnet, and other heavy minerals. In the above analyses the minerals were separated by the heavy-liquid method and by means of the Frantz Isodynamic Separator. An average of 50 percent (by weight) of the material of the concentrates is coarser than 6 mesh; approximately 35 percent is between 6 mesh and 20 mesh; and an average of 15 percent is finer than 20 mesh. The tin-bearing grains of sand size, and to some extent of granule size, in general consist solely of cassiterite; whereas the material of coarse granule and pebble size, although consisting largely of cassiterite, has an admixture of quartz and other constituents of the lode, of which they are detrital fragments. The coarse granules and pebbles range from medium grayish-brown to very dark brown.

The gold recovered by Vogt is coarse, the particles for the most part ranging from 2 to 10 millimeters in mean diameter. Small nuggets are not uncommon, and in 1943 Vogt recovered several that ranged in value from $8.00 to nearly $30.00 from cuts on the east side of Morelock Creek 200 feet upstream and 600 feet downstream from the mouth of Bonanza Creek. His largest nugget, which weighed 1.25 ounces, was in a pit about 2,100 feet downstream from the mouth of Bonanza Creek. The largest nugget reported from the area was found on the north side of Bonanza Creek about 1,320 feet above the mouth. Gold recovered by Vogt from prospect holes 21, 22, 23, and 24, and the adjacent cut 7 (fig. 3) in the creek bank has a fineness of 922.2 and a value of $32.28 per ounce. That this fineness and value is representative of the area is suggested by the fact that Vogt received approximately $32.00 per ounce for gold recovered from other parts of the mapped area.

Cassiterite and gold are present in the prospected area shown on figure 3, beginning just above the mouths of Bonanza and Homestake Creeks and extending approximately 3,200 feet down Morelock Creek valley. The alluvium-covered valley bottom in this area has a mean width of about 1,000 feet. Thus the valley bottom has an area of about 355,500 square yards, of which approximately one quarter has been prospected adequately. Prospecting has indicated that placer tin and gold are widely but sporadically distributed in the creek flat and in the benches on the northeast side of Morelock valley, the best prospects being in the creek flat. Sampling at smaller intervals than has been done possibly might permit the delineation of one or more definite paystreaks. Some tin and gold are known both upstream and downstream from the prospected area (fig. 3). The total extent of tin-bearing gravels along Morelock Creek is believed to be at least 1½ miles, and the average width of the tin-bearing area throughout this extent probably is 400-500 feet. Tin- and gold-bearing gravels also occur on Bonanza Creek, and extend at least 900 feet upstream from the mouth. Presumably very little gold or cassiterite occurs on Morelock Creek upstream from the prospected area (fig. 3), or on Homestake Creek. Mr. Vogt and others reported that prospecting was done on upper Morelock and Homestake Creeks many years ago, but apparently not enough gold was found to encourage intensive exploration, as little evidence of old pits could be found in these parts of the area.

PROSPECTING AND SAMPLING

At least 70 prospect holes and 6 small cuts were opened in the tin-bearing area by Vogt, John Irving, and other prospectors prior to 1943. Some of these pits and cuts were sampled by the Geological Survey in 1942, but many could not be sampled because they were caved or filled with water. No systematic sampling program could be carried out, and the samples were taken at random. Much of the information on the quantity of tin and the value of gold recovered from certain areas on bedrock was obtained from Mr. Vogt. He also provided several large samples of concentrates, and information as to the area of bedrock on which they were recovered.

The U.S. Bureau of Mines exploration program in this area in 1943 (Thomas and Wright, 1948a) included twenty-five 6.25-inch churn drill holes. They were spaced on 100-foot centers on two lines (fig. 3) that crosscut the valley bottom of Morelock Creek in the tin-bearing area, and on 50-foot centers on a line crosscutting Bonanza Creek about 300 yards above its mouth. Four small test pits, one caisson shaft, and three of Vogt's cuts also were sampled.

The testing of the area of tin-bearing gravel is not complete enough to give a basis for a good estimate of the total tin and gold content of the gravel. Also, the upstream and downstream limits of tin-bearing gravel on Morelock Creek have not been established, and the presence or absence of tin and (or) gold in the gravel of Homestake Creek valley has not been demonstrated.

The analyses of prospecting and drilling samples given in table 1 indicate that placer tin and gold are in the parts of the valleys of Bonanza and Morelock Creeks that are shown on figure 3. The distribution of tin and gold within this area is irregular, the amounts ranging from 0 to 1.62 pounds of tin per square yard, and from 0 to 0.359 ounces of gold per square yard. Most of the analyses (table 1) were made by the Geological Survey or the Bureau of Mines, and some are from the apparently reliable reports of Mr. Edward Vogt.

In the vicinity of the mouth of Bonanza Creek the average tin content, assuming 57 percent tin in the cassiterite concentrate, of samples from prospect pits 1 through 9 (fig. 3) is about 0.7 pound per square yard. In 1943 Edward Vogt mined cuts 1 and 2 on the bank of Morelock Creek just upstream from the mouth of Bonanza Creek; from 32.9 cubic yards of gravel and bedrock in cut 1 he recovered 0.0097 pound of tin and 0.0195 ounce of gold per cubic yard, and from 31.6 cubic yards in cut 2 0.0262 pound of tin and 0.0316 ounce of gold per cubic yard (Thomas and Wright, 1948a, p. 8). The Bureau of Mines drill line 7.0 about 800 feet upstream from Bonanza Creek was not completed, and there is a discrepancy in reporting the results for the two holes (180 and 190) drilled near the edge of the valley bottom. Thomas and Wright (1948a, p. 5, 7) state in their text that no tin or gold was found, but show in their table 0.0341 pound of tin per cubic yard for hole 190.

Table 1.--Tin and gold content of samples from Morelock and Bonanza Creeks valleys

Location of sample	Tin (pounds per sq yd)	Gold (ounces per sq yd)
Prospect pits:		
1 through 9--------	1/0.72 (avg)	1/0.168 (avg)
10 through 13------	(2)	(2)
14----------------	3/ .33	(2)
15 through 19------	(4)	3/ .036 (avg)
20 through 23------	(5)	(5)
24----------------	?	3/ .198
25----------------	(2)	?
26----------------	?	1/ .036
27 through 34------	(2)	3/ .171 (avg)
35----------------	3/ .67	?
Cut 3---------------	1/0.45	1/0.09
Cut 5 (upper half)---	1/1.62	3/ .072
Cut 6---------------	1/ .82	3/ .048
Upper half of cut 7 (incl. pits 20-23)--	1/ .90	} 3/ .31
Lower half of cut 7--	1/1.17	}
Test pit 1----------	6/ .0008	6/ .0026
2----------	6/ .0393	6/ .0022
3----------	6/ .0153	6/ .0051
4----------	6/ .0603	6/ .359
Caisson shaft--------	6/ .1089	6/ .113
Line 15, holes 4.0 through 6.0--------	6/0.1492 (avg)	6/0.0328 (avg)
Line 7, hole 180-----	6/ .0	6/ .0
Line 7, hole 190-----	6/ .0682 ?	6/ .0
Line 8.5, holes 110 through 180--------	6/ .2773 (avg)	6/ .0085 (avg)
Line 10, holes 120 through 190--------	6/ .0	6/ .0

1/ Sample and analysis by U.S. Geological Survey, 1942.
2/ Presence reliably reported but quantity uncertain.
3/ Quantity reliably reported.
4/ Present; quantity not determined.
5/ Present and included in amount for upper half of cut 7.
6/ Sample and analysis by U.S. Bureau of Mines, 1943.

Tin and gold are present in the part of Morelock Creek valley between 600 and 1,500 feet downstream from the mouth of Bonanza Creek. Cuts 4, 5, and 6, several old prospect pits, and Bureau of Mines drill line 8.5 and test pits 1 through 4 (fig. 3 and table 1) give a general idea of the tin and gold content of the placer deposits. Tin ranging from 0.0008 to 1.62 pounds per square yard and gold ranging from 0.0022 to 0.359 ounce per square yard have been recovered or reported. Tin averaging 0.329 pound per cubic yard and gold averaging 0.0455 ounce per cubic yard were recovered from 6.8 cubic yards of material in cut 4 (Thomas and Wright, 1948a, p. 8). Little is known about the tin and gold in the block of ground between cut 4 (fig. 3) and cut 3 at the mouth of Bonanza Creek, and nothing is known about the deposits in the block of ground between cuts 6 and 7 (fig. 3).

Tin and gold are known in the area of cut 7 and prospect pits 20 through 35 (fig. 3), about 2,000 to 2,800 feet downstream from Bonanza Creek. As shown in table 1, cassiterite and gold were recovered from the cut and pits, although the holes on Bureau of Mines drill line 10 yielded none. As much as 1.17 pound of tin and 0.31 ounce of gold per square yard have been recovered or reported in this area.

Placer tin and gold were reported by Mr. Vogt and others, and were found by the Geological Survey party in prospect holes, cuts, and creek-bank exposures in the Morelock Creek area outside of the three small areas discussed above. Tin deposits probably are present in at least half of the part of the valley of Morelock Creek shown on figure 3. Some tin and gold probably are in the placer deposits in the creek flat between the three small areas mentioned above, in the benches on the northeast side of the valley of Morelock Creek, and in the large part of the creek flat that lies on the southwest side of the creek and extends the entire length of the mapped area on figure 3. Tin probably is present in the valley of Morelock Creek downstream from the area shown on figure 3. Mr. Edward Vogt reported finding placer tin and gold in Morelock Creek valley upstream from Bonanza Creek, and the Geological Survey party in 1942 also found some in two creek-bank exposures between Bonanza and Maggie Creeks (fig. 2). The lower part of the valley of Bonanza Creek contains tin as shown by Bureau of Mines drill line 15 (table 1); Homestake Creek valley may possibly contain some tin and gold. Some prospecting on this creek was reported, but the records of it were not available.

MINING CONSIDERATIONS

As most of the tin and gold of the Morelock Creek area is on bedrock or in crevices and riffles in the bedrock surface, at least the upper 6 to 12 inches of bedrock must be mined to insure maximum recovery. Thus, after approximately 8 feet of barren overburden is stripped off, the total thickness of tin-bearing material to be mined, including the bedrock and bottom foot of gravel, does not exceed 2 feet. Removal of the upper 6 to 12 inches of bedrock would be a simple undertaking in the belts of soft schistose rocks, but probably would be difficult and costly where the bedrock is massive greenstone or quartz-mica schist. The irregular configuration of the bedrock surface might give rise to some difficulties in mining.

An adequate supply of water for small-scale mining is available in Morelock Creek and its tributaries, Homestake and Bonanza Creeks. Surface mining would not be hampered by frozen ground, as most of the alluvial material is not perennially frozen except for some of the deepest portions near the base of the valley wall.

Prospecting indicates that the tin deposits of the Morelock Creek area are of low grade and that a large area of ground would have to be worked to obtain even a relatively small quantity of tin. Additional drilling might be advisable to test the lower parts of the valleys of Bonanza and Homestake Creeks, and to test the valley of Morelock Creek just above and especially below the area shown on figure 3.

The large proportion of magnetite with the cassiterite and gold in the concentrates might make it possible to trace paystreaks by means of a magnetometer survey in advance of drilling. It should be noted, however, that in some of the tributary valleys and in parts of the valley of Morelock Creek, magnetite may not be accompanied by significant quantities of cassiterite or gold.

PLACER TIN DEPOSITS IN THE MORAN DOME AREA

By Robert R. Coats and Robert M. Chapman

INTRODUCTION

This report summarizes the results of field work by the Geological Survey in the Moran Dome area during parts of the 1942 and 1943 field seasons, and additional information, obtained as a result of exploratory drilling, trenching, and sampling under a Defense Minerals Exploration Administration contract in 1952. The objectives of the work in 1942 and 1943 were to determine the extent of the reported placer tin (cassiterite), and to locate, if possible, the lode source of the cassiterite. The major part of the field work in the Tozimoran Creek drainage was done in 1942 by Robert R. Coats, assisted by William N. Laval, geologic field assistant, Fred G. Rich, camp hand, and Robert W. Hackleman, cook. In 1943 Robert M. Chapman, assisted by Donald E. Mathewson, geologic field assistant, and Joseph Dlouhy, cook, continued work in the Tozimoran Creek drainage and extended the geologic reconnaissance into the upper Melozimoran Creek drainage. In September 1952 Robert M. Chapman, assisted by Richard G. Smith, geologic field assistant, and in cooperation with James H. Hulbert of the U.S. Bureau of Mines, visited the Tozimoran Creek property for the Defense Minerals Exploration Administration to examine the drilling project and to do other sampling and mapping of the placer deposits. The cooperation and assistance rendered by Mr. I. W. Purkeypile in 1942 and 1952, and by the late Mr. Martin Webories in 1942 and 1943 is gratefully acknowledged. A large portion of this report was originally written by Coats, and the additional information gathered in 1943 and 1952 has been incorporated by Chapman.

The placer deposits on the bench near the head of Tozimoran Creek were examined in 1939 by Livingstone Wright, a mining engineer in private practice, and were visited briefly in 1940 by F. F. Barnes, then geologist for the Alaska Railroad, but no reports were published. In September 1944 a U.S. Bureau of Mines party did exploratory work and some sampling of the placer deposit along upper Tozimoran Creek (Thomas and Wright, 1948b).

The Moran Dome area includes the uppermost 6 miles of the drainage basin of Tozimoran Creek, a small stream that drains the northeast flank of Moran Dome and flows eastward into the Tozitna River, and the uppermost 5 miles of the drainage basin of Melozimoran Creek, a small stream that drains the north flank of Moran Dome and flows northwestward into the Little Melozitna River. The area is about 25 miles northwest of Tanana, and is shown on figure 1. Moran Dome (3,608 feet) and Grant Dome (2,750 feet) are the two most conspicuous hills in the area.

The valleys of Tozimoran Creek and its tributaries within the mapped area (fig. 4) are steep walled, and the valley bottoms have moderately steep gradients. The gradient of Tozimoran Creek between Ash Creek and Slate Creek is approximately 80 feet per mile, but above the junction of Tozimoran and Ash Creeks the gradients increase rapidly to as much as 500 feet per mile, even in those parts of the valleys containing mappable quantities of alluvium. Melozimoran Creek heads in a large amphitheaterlike basin formed by the northern slopes of Moran Dome and adjacent ridges. Several tributaries join to form Melozimoran Creek, which flows northwestward in a broad, swampy, alluvium-filled, flat-floored valley bounded by long, low to moderate slopes. Weberies Creek and Grimm Creek, tributaries from the east and southwest respectively, flow in steep-walled valleys, and join Melozimoran Creek about 3.5 miles north of Moran Dome. Downstream from Grimm Creek, the valley of Melozimoran Creek is similar to that of Tozimoran Creek.

The area has considerable relief. The ridge tops, which are generally barren or covered with low brush or scrubby trees, reach an average altitude of about 2,100 feet, although areas in which the bedrock is more resistant to erosion, such as Grant Dome and Moran Dome, rise conspicuously above the general level of the ridge tops. The greater parts of the alluvial bottoms of the valleys of Tozimoran Creek and its tributaries in the map area have altitudes of 600 to 1,000 feet. The steep valley walls, covered with a scrubby forest of birch, poplar, alder, and spruce, rise abruptly from the alluvial floors of the valleys, which are also forested.

Freight for the district can be brought in by riverboat and barge and landed at the mouth of Grant Creek or the mouth of Lancaster Creek (fig. 4). From the mouth of Grant Creek a tractor trail extends 4 miles up the valley of Grant Creek to a placer mining camp. From the mouth of Monday Creek near the camp a horse trail about 12 miles long, following for most of the distance a ridge which is more than 2,000 feet high and well above timberline, allows access to the head of Tozimoran Creek at a point about 1,000 feet below the confluence of Ash Creek and at an altitude of about 800 feet. The horse trail, with minor deviations, could easily be converted into a tractor trail, although the 800-foot descent in the last 0.8 mile might offer some difficulties. A tractor trail, cleared in 1952, leads from the mouth of Lancaster Creek via the ridges into Tozimoran Creek above Ash Creek. Possibly heavy freight could be brought in during the winter more advantageously by tractor up the valleys of the Tozitna River and Tozimoran Creek. There are no trails leading into Melozimoran Creek, but several suitable routes, which would require some clearing of timber, could be selected.

Gold placer mining in the Tozimoran Creek area is said to have begun about 1902. The names of the locators and the amounts of work done by them are not known, little evidence of mining is visible, and little prospecting and mining were done. From 1924 to 1934, four claims on Tozimoran Creek were held by Mr. Fred C. Zickwolff of Tanana. He and one other man mined the cut, shown on figures 5 and 6 as cut 7, and recovered from it about 340 pounds of cassiterite concentrate and an amount of gold reported by him to be about 12 ounces. He also reported that from cut 1 (fig. 5) they recovered 6 ounces of gold. After Mr. Zickwolff left the area his claims are said to have lapsed, and the ground covered by them was included in claims staked by a partnership of Messrs. Martin Webories and I. W. Purkeypile. Ash, Chicken, Slate, and Wells Creeks are not known to have been systematically prospected, but some placer gold is reported in the valleys of these creeks.

Very little prospecting has been done on Melozimoran Creek and its tributaries, and the names of the early prospectors and exact locations of their prospects are unknown. A few prospect pits are said to have been sunk about 1913-1918 near the mouth of Melozimoran Creek, and reportedly some cassiterite and gold were recovered. Several claims were held in 1943 on Melozimoran Creek upstream from Grimm Creek by Martin Webories and I. W. Purkeypile, but little prospecting had been done on them.

The discovery of placer tin on " * * * Moran Creek, a tributary of Melozi River, where the gravels are said to contain 2½ pounds of tin and 10 cents worth of gold to the cubic yard" is mentioned by Martin (1920, p. 22). This may refer to the creek now known as Melozimoran Creek. In 1942, both Tozimoran and Melozimoran Creeks were referred to indiscriminately as Moran Creek, and the nomenclature adopted in this report was proposed at that time to prevent confusion. The tin occurrence mentioned by Martin was not necessarily from the part of Melozimoran Creek described in this report, and may even have been from some other creek, but was probably from a creek draining the slopes of Moran Dome. The authors have no other information on this occurrence. Smith (1932, p. 40) mentions that " * * * a little prospecting [for gold] was done in 1929 on Grant, Mason, and Moraine Creeks"; Moraine Creek was the name applied to Tozimoran Creek at that time by Mr. Zickwolff of Tanana. Smith (1932, p. 68) also mentions that placer tin was recovered in placer mining on Grant Creek. Although small-scale placer gold mining was being done on Grant Creek in 1942 and 1943 by the late Mr. Walter Fisher, no placer tin was present. Placer gold has been mined on Illinois Creek, about 9 miles west of Grant Creek, and on its tributary Golden Creek, about 6 miles south-southwest of Moran Dome, but prospectors familiar with these creeks did not report placer tin.

GEOLOGY

Little published information is available on the Moran Dome area. According to Maddren (1910), who visited the Gold Hill district (Grant Creek area) in 1908, the gold placers in that district were discovered in 1907. Maddren gives a brief geological description of the region. He correlates the schist with the Birch Creek Schist of Precambrian age, which is widely distributed in the Yukon-Tanana region. Eakin (1913a) has published a generalized geologic sketch map of the area as well as a brief description of the placer deposits of the Gold Hill district. He apparently did not visit Tozimoran Creek. Eakin (1916) includes this area in his later reconnaissance coverage of the Yukon-Koyukuk region and relates the local geology to the regional geology. Dutro and Payne (1957) include the metamorphic rocks in this area in a gross unit of undifferentiated Paleozoic metamorphic rocks, which is composed predominantly of rocks of pre-Devonian age, but may include some Precambrian and Mesozoic rocks.

Bedrock

The bedrock throughout the mapped area consists of a thick sequence of metamorphosed sedimentary and mafic igneous rocks and some granite. The sedimentary rocks are now chiefly quartzite, quartz-mica schist, and quartz-chlorite schist locally rich in chloritoid. The mafic igneous rocks have been metamorphosed to epidote-albite-chlorite-actinolite schists. A few thin lenses of marble and dolomitic marble are interbedded with the schists but have not been differentiated in the mapping. Light-pink to cream-colored granite of unknown age is exposed in the northwestern corner of the area and in part forms the ridges on the north side of Webories and Grimm Creeks. The granite is composed mainly of quartz, feldspar (mostly, if not entirely, orthoclase), and biotite, and is coarsely crystalline to porphyritic with some fine-grained border phases. Fine-grained granite dikes of similar composition cut the porphyritic phases of the granite in places. This granite appears to be part of a large pluton, possibly of batholithic size, that extends to the north and west of the upper Melozimoran Creek area.

Lenticular veins of milky quartz are very common in the region, but no metallic minerals were observed in them. Two small galena-cerussite veins lie on the south side of Tozimoran Creek; one is a short distance downstream from the cabin, and the other is just above the mouth of Ash Creek (Killeen and White, 1954; and Killeen, written communication, 1960). A reddish-brown gossan, approximately 25 feet in diameter, is exposed on the hillside a short distance north of the mouth of Ash Creek. No unweathered sulfides and no evidence of cassiterite mineralization were found in it.

The original bedding of the sediments has been obliterated by metamorphism, except at a few places, where it appears to be parallel to the cleavage. The cleavage is nearly horizontal over large areas, particularly in the southern part of the area mapped; commonly the dip is low and toward the southeast, but in the northern part of the area it is much steeper and in general toward the north. The most prominent jointing has a northeast strike and a steep northwest dip.

Alluvium

The placer tin deposits of the Moran Dome area, so far as is known, are confined to the alluvial deposits formed by the streams within the present valleys. For this reason the erosional history of the region is important in a study of the placer tin deposits. This history has not been one of continuous downcutting on the part of the streams; at various times downward erosion has been slowed sufficiently to permit development of relatively wide valley floors upon which alluvial gravel has been deposited. With accelerated downcutting these deposits have been largely swept away by the streams, leaving only minor remnants here and there as terrace deposits on the valley walls at various heights above the present streams. The deposits thus left stranded by stream erosion are described collectively as older alluvium, with no attempt to distinguish the deposits on older and higher benches from those on younger and lower ones. The deposits described as younger alluvium were laid down relatively recently by the streams, as shown by the fact that they rest on bedrock floors close to the level of the present streams, where they can be reached and rehandled by the streams in time of floods.

The distribution of frozen ground within the muck and gravel of the alluvium is apparently irregular, as indicated by observations, notes in the drilling logs, and reports by prospectors. In the area shown on figure 7, some of the drill holes, both in the valley floor and on the benches, are entirely in unfrozen ground, and none of them are entirely in frozen ground. The frozen ground appears to be in layers or lenses of various thicknesses and limited and irregular lateral extent. Farther downstream, about 1 mile above Slate Creek, two holes that reached bedrock at 16.2 and 17.7 feet were entirely in frozen ground, but two other holes closer to Tozimoran Creek had to be abandoned at a depth of 4 feet owing to water and unfrozen ground (Thomas and Wright, 1948b, p. 7-9).

Older Alluvium

The valley of Tozimoran Creek is the only one in this area in which a deposit of older alluvium has been explored and mapped. Deposits of older alluvium, most of which are relatively limited in extent, lie at several places along the creek above its confluence with Slate Creek. One of these is shown in figure 5 and is the only one that has been well developed by prospect openings made in the search for gold. Cassiterite is the tin mineral associated with gold. Other remnants of older alluvium have not been shown to contain economically significant amounts of gold or cassiterite. The northern three or four drill holes on lines 13 and 14 (fig. 7) penetrate the older alluvium.

Time, equipment, and economic justification were lacking for an intensive study of the narrower terrace remnants, but superficial observation suggests that they comprise several sets of different ages. The accordant remnants of any one set, which presumably were formed at about the same time, occur at slightly higher elevations above Tozimoran Creek with increasing distance from the headwaters; successively younger and lower sets make their appearance along the valley walls with increasing distance from the head of the stream.

The few observations made in the field suggest that the former longitudinal profile of Tozimoran Creek, obtained by restoration from the remnants of the highest set of terraces, would have an average gradient of about 33 feet to the mile between the mouth of Ash Creek and that of Slate Creek, or approximately one-half the gradient of the present stream.

The remnant of the highest set of benches, on which much of the prospecting work has been performed, is on the north side of Tozimoran Creek about 1,300 feet below the confluence of Tozimoran and Ash Creeks (fig. 4). Here a body of gravel about 1,000 feet long and 200 feet wide at the widest is perched on a rather even bedrock surface (fig. 5). The configuration of the bedrock surface beneath the gravel deposit is imperfectly known, but the evidence at hand suggests that the bedrock floor of the old valley slopes gently from both valley walls toward the bedrock channel, thus having in cross section the shape of an open and asymmetrical V. Probably the original bedrock channel did not everywhere occupy the center of the old valley. Part of the channel is now preserved beneath the gravel deposit of the bench mentioned above. The altitude of the bedrock surface below the older alluvium near the east end of the bench is about 10 feet higher than the altitude of the present stream bed.

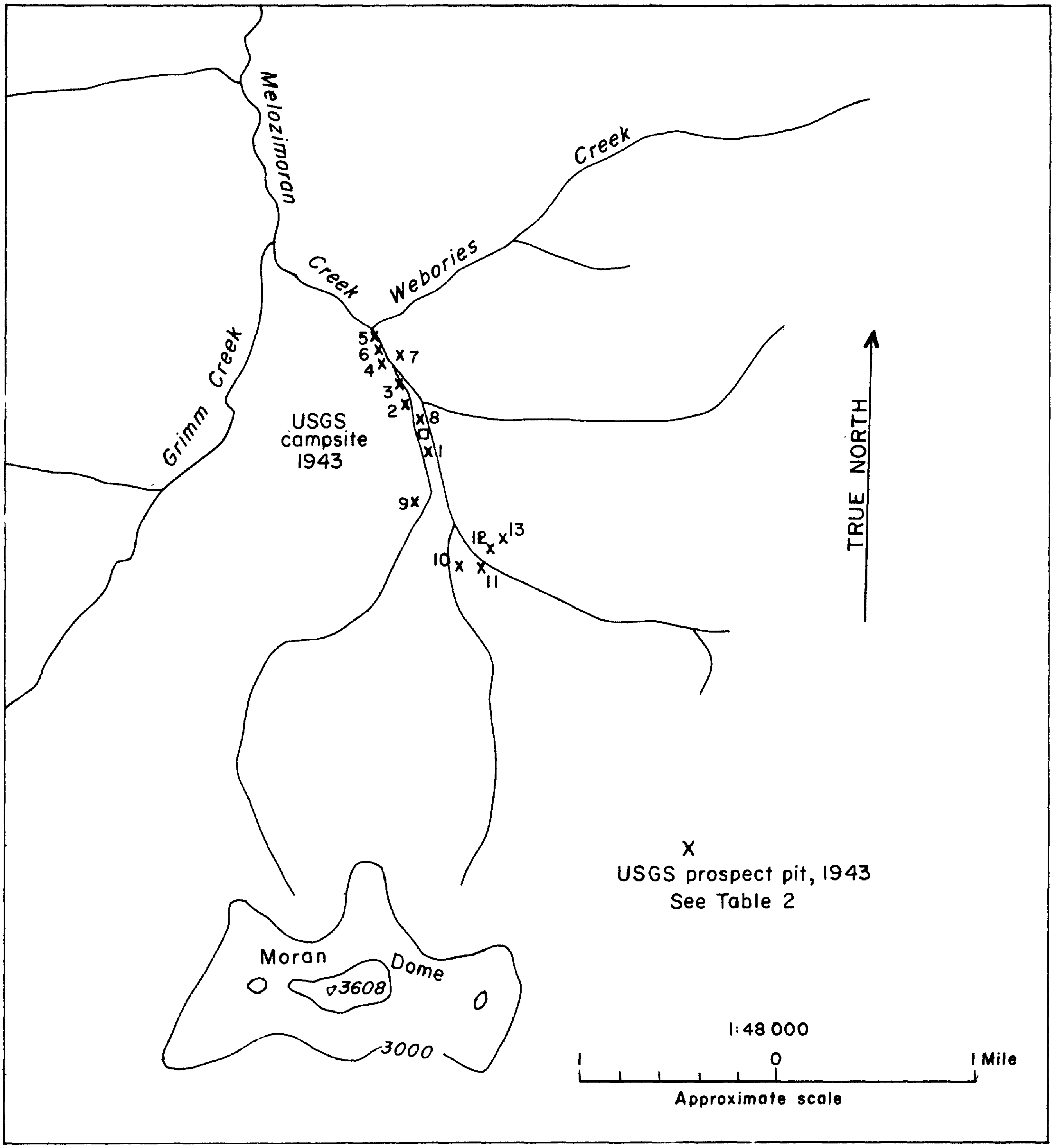
The gravel on this bench is frozen, except close to the edge of the bench or where disturbed by mining or prospect cuts, and is covered by a layer of gray silt, or "muck," which also is frozen and ranges in thickness from about 1 foot near the edge of the bench to about 18 feet near the margin of the old valley. A small thickness of disintegrated bedrock material and talus overlies the silt layer near the valley walls.

Where thawed the gravel of the bench is loose and is in part iron stained. It is moderately well stratified and fairly coarse. The largest boulder seen was about 3 feet in mean diameter, but such large boulders are rare, and few are more than 10 inches across. Little clay is present, although the schist bedrock locally is decomposed to a tenacious, claylike substratum composed mostly of fine mica.

In the valley of Melozimoran Creek within this area, the alluvium is largely confined to the floor of the present valley. A few older gravel benches, whose original configuration has been masked or partially destroyed by soil and talus movement, were recognized. One is on the west side of Melozimoran Creek and extends for nearly a mile upstream from the valley of Grimm Creek. Several small exposures of gravel about 30 feet above the present creek level were noted in this bench. A test pit (no. 4 on fig. 8) on this bench showed 14 inches of muck and 5.33 feet of rudely stratified gravel, sand, and some clay. Quartzite bedrock was reached at a depth of 6.5 feet. This pit, close to the edge of the bench, was in unfrozen ground. Several terracelike deposits believed to be underlain by older alluvium are on the east side of Melozimoran Creek beginning a short distance downstream from Grimm Creek. One creek bank exposure showed 3 feet of vegetation and muck, underlain by at least 6 feet of gravel, of which 30 to 35 percent is subangular to subround pebble- and cobble-size material and the remainder is granule, sand- and clay-size material. The greatest exposed thickness of bench gravel was 6 to 7 feet, but the total thickness of these gravels is probably greater. Whether these deposits are perched on bedrock benches is not known. Nor is it known whether this bench gravel is perennially frozen, but probably it is, except where exposed on the valleyward edge.

Younger Alluvium

The gravel of the present valley bottom of Tozimoran Creek is slightly coarser than that of the bench deposit. It appears to be predominantly unfrozen over a width of about 100 feet, judging from reports of prospectors, from the drilling logs, and from the distribution of vegetation. Where the valley floor is wider than 100 feet, the part of the alluvium more remote from the stream is more likely to be in part or entirely frozen.



Compiled by Robert M. Chapman
based on drainage from Tanana B-6
quadrangle

FIGURE 8.— SKETCH MAP SHOWING LOCATION OF PROSPECT PITS ON UPPER MELOZIMORAN CREEK

The approximate width of the deposits in the present valley bottom is shown on figure 4. The average width is about 250 feet in the part of the valley between the bench mentioned above and the mouth of Slate Creek, and about 150 feet in that part of the valley upstream from the bench to the confluence of Tozimoran and Ash Creeks. The alluvial deposits of these two streams, above their confluence, are even narrower and probably are quite shallow. For a distance of several miles below the mouth of Slate Creek, the average width of the alluvium in Tozimoran Creek is about 600 feet.

The depth of the alluvium in the present valley floor is known in the vicinity of the drill holes, where it is about 10 to 12 feet thick. Mr. Zickwolff reported that on the claim farthest downstream of his four on upper Tozimoran Creek, presumably several thousand feet below the mouth of Chicken Creek, a shaft reached bedrock at a depth of 27 feet. Three shafts about 150 feet apart were sunk during the summer of 1942 on the south side of Tozimoran Creek about 1,000 feet below the mouth of Slate Creek; one reached bedrock at a depth of 13 feet, and two at 11 feet. Another shaft near the mouth of Slate Creek is reported to have reached bedrock at a depth of 25 feet. It seems reasonable to assume a mean depth of 15 feet for the younger alluvium in the valley of Tozimoran Creek between Ash Creek and Slate Creek.

Knowledge of the type and thickness of alluvium in the present valley bottom of Melozimoran Creek is meager. The thickness of alluvial material in Melozimoran Creek and tributaries upstream from Grimm Creek probably does not exceed 10 to 15 feet; however, no prospect pits that reached bedrock were seen, and reports on early prospecting are vague. The valley floor above Webories Creek is swampy and overgrown with brush and many willows. The creek flows in two channels, at the sides of the valley floor, that join several hundred yards above Webories Creek. As far as known from test pits and reports, the alluvium is frozen in some parts of the valley and unfrozen in others.

The Geological Survey party in 1943 dug 10 pits in the valley floor on Melozimoran Creek. The locations and logs of these pits (nos. 1-3, 5-11) are given in figure 8 and table 2, respectively. Some of these bottomed in frozen ground at depths ranging from 0.5 to 3 feet, and others encountered active seepage of ground water at approximately these same depths. As this work was done in late August, it can be assumed that seasonal thawing had reached its maximum and that the frozen ground encountered is perennially frozen. The gravel is composed of subangular to subround fragments of quartzite, greenstone, and schist, ranging in size from a quarter of an inch to 10 inches in mean diameter. The total section of alluvium is moderately well stratified, in layers of clay, sand, and sandy gravel. Two holes, nos. 12 and 13 on figure 8, were dug on a low slope covered by moss, lichen, heath, and scrub spruce on the east side of Melozimoran Creek valley approximately 2 miles upstream from Webories Creek. In these holes, approximately 3 and 6 feet above creek level, 1 to 1.5 feet of vegetation mat overlies frozen much. Bedrock was not reached in any of the 12 holes.

Table 2.--Geologic logs of prospect pits in Melozimoran Creek valley

Pit	Total depth (feet)	Description	Ground condition at bottom
1	2	0.3 ft, muck; 1.7 ft, fine sand and coarse gravel. Water in bottom.	Unfrozen
2	1.9	0.6 ft, muck; 1.3 ft, brownish-yellow clay with angular fragments of quartzite.	Frozen
3	.5	0.5 ft, muck. Clay below.	Frozen
4	6.6	1.0 ft, muck; 2.7 ft, gravel, coarse and fine, 1/4 to 5 in. diameter, moderately well rounded; 0.8 ft, gravel, fine material, 1/8 to 1/2 in. diameter; 1.1 ft, gravel, coarse and fine, 1/4 to 5 in. diameter; 1.0 ft, yellow clay, with some fine gravel and angular quartzite. Quartzite bedrock below.	Unfrozen
5	1.5	1.0 ft, muck; 0.5 ft, green clay.	Frozen
6	1.0	1.0 ft, muck; green clay and one angular piece of quartzite.	Frozen
7	.8	0.6 ft, muck; 0.2 ft, green clay.	Frozen
8	3.0	1.0 ft, muck; 2.0 ft, green clay and gravel from sand to cobble size. A 0.2-ft layer of muck at depth of 2.0 ft.	Frozen
9	6.5	0.3 ft, muck; 2.1 ft, brown clay with a 0.2-ft layer of green clay. Fragments of talus. 1.8 ft, green clay; 2.3 ft, talus fragments with clay, mostly 0.1 to 0.3 ft diameter. Sticky gray clay and some gravel; water in bottom.	Unfrozen
10	3.0	1.0 ft, muck and talus; 2.0 ft, silt, sand, and gravel, 0.1 to 0.9 in. diameter. Water in bottom.	Unfrozen
11	4.5	1.5 ft, muck and talus; 3.0 ft, silt, sand, and gravel, 0.1 to 0.7 in. diameter. Water in bottom.	
12	1.0	1.0 ft, muck.	Frozen
13	1.5	1.5 ft, muck.	Frozen

Mr. Martin Weebories reported that in a prospect pit on Weebories Creek a short distance above its mouth, 12 feet of gravel overlies bedrock. This pit could not be located in 1943, but, judging from the appearance of the valley and from data on other similar sites in the Moran Dome area, this is a reasonable thickness for the gravel fill in the lower course of Weebories Creek. In addition to the previously mentioned rock types, granite is a prominent constituent in the gravel on Weebories and Grimm Creeks. The gravel thickness encountered in a few prospect pits near the mouth of Melozimoran Creek, which is approximately 6 miles north of the mouth of Weebories Creek, was reported to be slightly more than 12 feet.

PLACER DEPOSITS

Bedrock Source

The writers know of no tin or gold in bedrock in the Moran Dome area. The tin in the gravel is in the form of cassiterite (SnO_2). Some pebbles and cobbles contain other minerals with cassiterite and are therefore distinguished from pure cassiterite by the use of the term tinstone. Two of these, sectioned for microscopic examination, contain cassiterite in the form of narrow veinlets in a micaceous quartzite. Pale-brown tourmaline is associated with the cassiterite in these veinlets. Many pebbles of dark-brown limonite are found in the placer concentrates, but none appears to contain any tin, and there is no reason to suppose that the sulfide minerals from which the limonite was derived were associated with cassiterite in the bedrock. Examination of thin sections of other rocks collected throughout the Grant Creek-Tozimoran Creek area shows tourmaline in many of the rocks from the headwaters area of Tozimoran Creek, but not in the rocks from the drainage basins of Golden, Grant, and Lynx Creeks, in which no deposits of placer cassiterite are known, although each of them does have placer gold. Possibly the distribution of tourmaline might be used as a guide in prospecting for the bedrock source of cassiterite. This method, however, would require much laboratory work because the tourmaline is present in very small amounts except in those rocks which contain cassiterite, and even in them it is so inconspicuous that it is hardly recognizable in hand specimens.

Older Alluvium

The cassiterite in the gravel on Tozimoran Creek consists of subangular to angular sand grains, pebbles, and cobbles weighing as much as 3 pounds. It is opaque and black in large pieces, and translucent and dark brown in sand-sized grains. A size analysis of the cassiterite concentrate from the bench deposit was made for Livingston Wright. He found that 70 percent by weight remained upon a ¼-inch mesh screen. R. R. Coats estimates that 90 percent by weight of the cassiterite is in the form of grains larger than 1 millimeter across. Pieces weighing an ounce or more are common, and any cubic-foot sample of rich gravel will probably contain one or more; no very rich sample lacked coarse cassiterite. The larger grains show more rounding and smoothing by stream abrasion; this difference may, in part, be accounted for by a longer period of exposure of the coarser grains than of the finer grains, which are moved more rapidly downstream.

The gold is clean and moderately angular. A fineness of about 895 was reported to Coats; however, a fineness of 835 was determined by the U.S. Bureau of Mines laboratory on a combined sample of all the gold recovered from the cut and drill hole samples taken in 1952. The largest nugget found on Tozimoran Creek by Mr. Zickwolff was said to weigh slightly more than 0.2 ounce. The largest piece found in the course of sampling by the Geological Survey party in 1942 is worth about 10 cents; most of the gold is in the form of grains worth more than 0.5 cent.

The experience of the miners, and of the engineers who have examined the Tozimoran Creek deposit, suggests that all of the cassiterite and gold in the gravel is concentrated very close to bedrock. The writers' investigations confirmed this conclusion. Some gold, but very little cassiterite, seems to penetrate short distances into bedrock crevices. Perhaps the cassiterite does not penetrate as deeply because of its greater average size and lower specific gravity. Neither gold nor cassiterite is known to penetrate the bedrock to a depth greater than 6 inches (Thomas and Wright, 1948b, p. 4).

Insofar as known from reports and field observations, no prospecting has been done in the bench deposits on Melozimoran Creek. Samples from pit 4 (fig. 8), dug by the Geological Survey in 1943, were panned and were found to be devoid of gold, cassiterite, and any other heavy minerals.

Younger Alluvium

Relatively little is known concerning cassiterite and gold in the younger alluvium. In the upper reaches of Tozimoran, Ash, and Melozimoran Creeks the alluvium, because it is unfrozen, cannot be prospected by shafts or pits without caissons and pumps. Four holes dug on Ash Creek and on Tozimoran Creek near the mouth of Ash Creek by the U.S. Bureau of Mines had to be abandoned, owing to water, before bedrock was reached (Thomas and Wright, 1948b, p. 10). Gold and tinstone or cassiterite on Ash Creek and on Tozimoran Creek near and above the confluence with Ash Creek have been shown in samples from drill holes on lines 1, 2, 3, 9, and 10 (fig. 7). It is reported that tinstone, to the extent of 27 pounds per cubic yard, and gold were recovered from a sample taken from the face of the drift that was run from the bottom of a shaft below the mouth of Chicken Creek, presumably close to bedrock. The 25-foot shaft just below the mouth of Slate Creek is said to have yielded $1.65 in gold and 7 pounds of tinstone. The walls of all three shallower shafts below the mouth of Slate Creek were frozen below the depth of seasonal thaw. The northernmost of these shafts was about 170 feet from the present stream and was about 13.5 feet deep; the uppermost foot was through black silt and the rest through well-sorted fluvial gravels. The other two shafts were each 11 feet deep. Sampling of the most northerly two shafts yielded at the rate of 0.26 and 1.75 pounds tin metal per cubic yard of the material sampled, which was the lowest 1.5 feet of gravel and uppermost 0.5 foot of bedrock. Dilution of this material with the overlying, nearly barren material would give average values of 0.04 and 0.47 pound of tin per cubic yard. The sample from the middle shaft had a gold content of $0.10 per cubic yard, in addition to the tin.

No reliable data are available on the occurrence or distribution of gold or cassiterite on Melozimoran Creek. Samples of the material available in the pits dug in the valley floor in 1943 by the Geological Survey (fig. 8) were panned and no gold or cassiterite were found. As these samples were taken well above the base of the gravel, however, where the heavy minerals, if present, are normally found, the negative results have little significance.

EXPLORATION AND SAMPLING

The data pertaining to the tin and gold content of the younger, or valley floor, alluvium are inadequate to make a conclusive evaluation of the potential deposits. The only place in which adequate sampling of the older, or bench, alluvium has been done is on the bench along Tozimoran Creek 1,000 to 1,800 feet below Ash Creek (fig. 5).

As shown on figure 5, samples were taken by the Geological Survey in 1942 at 20-foot intervals from the placer cuts in the older alluvium bench along Tozimoran Creek. These samples were cut as vertical channels in the lowest 1.5 feet of the gravel and the uppermost 0.5 foot of bedrock. The samples were concentrated first in a rocker and finally by panning, and the tinstone and gold were weighed (table 3). These and other samples in this bench area suggest a paystreak that is estimated to be 900 feet long. The bench and paystreak have been cut out by stream erosion a short distance upstream from cut 7, as shown by the section in drill hole 5 on line 11 (fig. 7 and table 5).

Table 3.--Gold and tinstone in samples from cuts in older alluvium bench deposit, Tozimoran Creek

[Sampled by Coats in 1942 (fig. 5). All samples from approximately bottom 1.5 feet of gravel and top 0.5 foot of bedrock]

Cut No.	Sample No.	Sample Volume excavated (cubic feet)	Gold (milligrams)	Tinstone (grams)
1	1	0.67	--	0.35
1	2	.67	9	16.9
1	3	1.34	10	15.32
1	4	do	15	5.05
1	17	do	22	112.36
2	6	do	9	145.45
2	18	do	1/ 1.5	12.36
3	8	do	71	9.77
4	9	do	28	--
4	10	do	1/ 0.4	1.07
4	11	do	1/ 1.0	.54
4	12	do	17	226.8
5	13	do	48	46.87
5	14	do	1/ 0.3	2.96
6	15	do	72	26.45
6	16	do	1/ 0.7	29.34
7	19	do	1/ 1.0	12.25
7	20	do	1/ 6.0	--
7	21	do	80	67.42
7	32	do	33	.4
8	22	do	46	35.04
8	23	do	54	50.0
8	24	do	15	10.275
8	25	do	112	149.28
8	26	do	28	48.6
9	27	do	1.1	1.01
9	28	do	21	11.588
9	29	do	10	17.738
10	30	do	7.3	5.62
10	31	do	20	99.0

1/ Visual estimate.

The tinstone in this deposit has undergone an amount of abrasion incompatible with a hypothesis of strictly local derivation. There is thus reason to believe that the original paystreak in the older alluvium, before erosion, extended for some distance up and down Tozimoran Creek. If the tin and gold are derived largely from a source nearer the head of the creek, and there are no other local sources below the bench in the valley of Tozimoran Creek or its tributaries, then the value of the deposits in the older alluvium per foot of valley length probably declined at some unknown rate with increasing distance from the source. It is assumed that the tin and gold content of the eroded deposits of older alluvium is now in the younger alluvium of Tozimoran Creek, and that its present site is no great distance downstream from its former one. The values obtained from the shafts sunk to bedrock in the younger alluvium below the mouth of Slate Creek are much lower than those found in the paystreak in the older alluvium on the bench near the head of the creek, but it is not certain that any of these holes sampled the present paystreak in the younger alluvium.

In 1952 James H. Hulbert, of the U.S. Bureau of Mines, and Robert M. Chapman examined cuts 7 and 8 and laid out a sampling program that was executed by the operator, Mr. I. W. Purkeypile, under D.M.E.A. contract, after these cuts were retrenched to bedrock by a bulldozer. The sections exposed in the cuts and the sample locations are shown in figure 6. A channel sample, consisting of six level-full standard gold pans (approximately equal to 1 cubic foot of material) was taken at 12 sites from the gravel section and top 0.5 foot of bedrock freshly exposed in the walls of the bulldozer trenches. These 12 samples, plus 1 grab sample collected by Hulbert and Chapman from cut 7, were taken, concentrated in a rocker, and then in a pan by the drill crew. These concentrates were weighed and assayed for tin and gold by the U.S. Bureau of Mines in Juneau, Alaska. The weights of tin metal and gold are given in table 4. Three drill holes, line cut 7, holes 1 and 2, and line cut 8, hole 1 (fig. 7), are close to cuts 7 and 8. The thickness and tin content of the gravel section in these holes are given in table 5. Hole 1 on line cut 7 is 30 to 40 feet west of samples 4 and 5 in cut 7, and the tin recovered, calculated on a square foot basis, shows about 9.58 grams per square foot in contrast to about 412 and 284 grams per square foot for samples 4 and 5 in the wall of the cut.

It seems certain that recovery of gold and tinstone from most of the drill holes was not complete. The holes were drilled with a churn drill, and standard drilling procedure for unfrozen ground was used. A defective sand pump was used to bail most of the holes, and owing to unfortunate circumstances it could not be replaced until nearly all of the drilling was completed. Comparative tests indicated that the first pump did not make effective recovery, and tests of the replacement sand pump showed that 100 percent recovery of tinstone was not achieved with it in every case. Thus, the tin contents given in table 5 for the drill holes are minimum amounts, and no reliable correction factor can be applied.

Table 4.--Thickness of section and tin and gold content of samples from cuts 7 and 8, Tozimoran Creek

[Samples are channel samples from gravel section and top 0.5 foot of bedrock. Volume of sample 6 standard gold pans full, approximately 1 cubic foot]

Cut No.	Sample No.	Thickness: Muck (feet)	Thickness: Gravel 1/ (feet)	Weight: Concentrate from sample (grams)	Weight: Tin metal in concentrate (grams)	Weight: Gold in sample (milligrams)
7	1	0.5+	2.3	31.90	15.663	3.35
7	2	2.5+	3.0	21.85	11.165	34.2
7	3	1.0	2.4+	165.60	97.704	351.2
7	4	5.0	3.4	131.30	90.728	48.65
7	5	5.0+	4.3	88.72	51.103	8.55
7	Grab 2/	--	--	29.50	18.172	55.80
8	1	1.2+	1.0	98.35	54.584	3/ 17.0
8	2	2.2	4.7	69.20	38.475	25.15
8	3	2.3	5.4	95.00	51.870	62.05
8	4	3.6	5.3	65.52	29.943	3/ 5.0
8	5	4.5	4.9	19.60	4.978	39.20
8	6	5.5	5.4	46.00	21.620	36.85
8	7	5.9	5.5	49.70	12.326	56.35

1/ Thickness as exposed when examined; some may be slightly greater to top of bedrock.

2/ Sample volume is 1 pan or 1/6 cubic foot.

3/ Weight taken from operator's field record. Sample not assayed by U.S. Bureau of Mines.

Table 5.--Depth and thicknesses of sections in drill holes and tin content of drill-hole samples in Tozimoran and Ash Creek valleys

[Diameter of the cutting edge of drill shoe is 0.52 foot. Area of drill hole 0.21 square foot]

Line	Hole	Depth (feet)	Thickness (feet): Moss, muck, and talus (if present)	Thickness (feet): Sand and gravel	Thickness (feet): Bedrock penetrated	Weight (grams): Sample	Weight (grams): Tin in sample
1	1	18.5	4.0	13.0	1.5	32.17	0.867
1	2	16.0	3.0	11.0	2.0	27.45	1.606
2	1	16.0	2.0	12.0	2.0	26.93	.337
2	2	13.0	1.0	10.0	2.0	25.65	.450
3	1	20.5	3.0	13.5	4.0	78.15	2.269
9	1	19.0	.5	14.5	4.0	55.77	.052
9	2	16.0	4.0	8.0	1/4.0	13.75	.082
10	1	16.0	8.0	6.0	2.0	21.11	1.641
10	2	14.0	1.0	11.0	2.0	17.02	1.906
10	3	13.0	2.0	9.0	2.0	23.75	1.493
10	4	13.5	1.0	11.0	1.5	38.60	15.295
10	5	13.0	1.0	9.5	2.5	.70	.022
11	5	13.0	12.0	0	1.0	--	--
Cut 7	1	18.0	2.0	2/12.5	3.5	50.75	2.011
Cut 7	2	25.0	9.0	2/14.0	2.0	17.30	0.657
Cut 8	1	23.0	16.0	4.0	3.0	34.30	.360
13	1	15.0	1.0	13.0	1.0	14.55	1.557
13	2	14.0	2.5	10.5	1.0	72.50	1.746
13	3	12.0	2.5	7.5	2.0	100.0	1.081
13	4	10.0	2.5	6.5	1.0	46.35	.131
13	5	15.0	7.5	6.0	1.0	12.54	1.317
13	6	16.0	6.0	6.0	4.0	60.95	.248
13	7	16.0	8.0	7.0	1.0	82.60	2.287
13	8	16.0	1.0	10.0	3/5.0	7.85	.025
13	9	16.0	1.0	13.0	2.0	6.85	1.370
14	1	13.0	2.0	10.0	1.0	293.50	5.819
14	2	10.0	3.5	5.5	1.0	32.50	2.401
14	2A	13.0	2.5	8.5	2.0	60.25	1.059
14	3	17.0	2.5	13.5	1.0	107.70	1.791
14	4	15.0	4.5	9.5	1.0	10.17	.187
14	5	12.0	0.5	9.5	2.0	12.00	.036
14	6	10.0	1.0	6.0	3.0	--	--

1/ Sticky clay, probably weathered bedrock.
2/ Partly muck.
3/ Sticky clay and talus, probably not into bedrock.

The valley floor alluvium and, where present, part or all of the older bench alluvium were prospected in 1952 by 23 drill holes on lines 9, 10, 13, and 14, and four other holes that were drilled in the bench deposit near cuts 7 and 8. Five holes on lines 1, 2, and 3 were drilled in the valley floor alluvium on Ash Creek. The locations of these holes, and geologic cross sections based on data from drillers' logs, are shown on figure 7. The material from the drill holes was collected and concentrated by panning by the operator. The concentrates were weighed and assayed for tin by the U.S. Bureau of Mines in Juneau. The small amounts of gold in each concentrate were not weighed individually, except for those from line 9, hole 1 (9.60 milligrams from 3.25 cubic feet of sample material) and line 13, hole 5 (3.31 milligrams from 1.47 cubic feet of sample material), but were lumped with the gold recovered from 11 of the 13 samples (volume 10.166 cubic feet) from cuts 7 and 8. The combined gold samples, weighing 734.26 milligrams (from a sample volume of about 75 cubic feet), have a fineness of 835.

The samples taken in 1944 by the U.S. Bureau of Mines (Thomas and Wright, 1948b) from the bench deposit in cut 7 on Tozimoran Creek show very similar results for tin and gold to those of three comparably located samples taken by the operator in 1952. The 1944 samples in cut 8 show considerably lower amounts of tin and gold than occur in three similarly located samples taken in 1952. Three channel samples taken from cut 1 by the U.S. Bureau of Mines in 1944 show tin and gold contents that are roughly similar to those obtained from Coats' samples taken from cut 1 in 1942 if slight differences in sample locations and methods of handling are considered.

Two holes, line 24, holes 3 and 4, 50 feet apart, were sunk to bedrock through the valley floor alluvium of Tozimoran Creek 1.5 miles downstream from the bench deposit and cuts 7 and 8 (Thomas and Wright, 1948b, p. 7-9). Here the ground was frozen, but in two holes closer to the creek unfrozen ground and water were found and the holes had to be abandoned before bedrock was reached. The depth to bedrock in holes 3 and 4 is 16 and 17.7 feet respectively; 620 grams of tinstone concentrate (52.16 percent tin) and 460.91 milligrams of gold were recovered from hole 3 (calculated volume, 50.2 cubic feet), and 734 grams of tinstone concentrate (49.02 percent tin) and 455.84 milligrams of gold were found in hole 4 (calculated volume, 70.4 cubic feet). Seven other holes were attempted by the U.S. Bureau of Mines on upper Tozimoran Creek near Ash Creek, and one on Ash Creek; in all eight, unfrozen ground and water were found and the holes were abandoned before bedrock was reached.

The valley floor alluvium on Ash Creek was prospected in 1952 by five drill holes located on lines 1, 2, and 3, which are spaced about 1,200 and 1,000 feet apart (fig. 7). The tin recovered from these holes, as determined from assays by the U.S. Bureau of Mines, is given in table 5. A comparison of the tin content of these holes with that of the two holes on line 9 on Tozimoran Creek above the mouth of Ash Creek indicates that the Ash Creek drainage area is the greater source of cassiterite mineralization. Again, it should be remembered that neither uniform nor complete recovery of tinstone and gold was made from these holes.

Any consideration of the advisability of mining for tin and (or) gold in this area should be based upon some additional exploration and sampling on Tozimoran and Ash Creeks. Prospecting of upper Melozimoran Creek and its tributaries, and possibly of Wells Creek, should be considered also.

INVESTIGATION OF REPORTED PLACER TIN IN THE MASON CREEK AREA

By Robert M. Chapman

INTRODUCTION

Mason Creek is a small south-flowing stream about 8 miles long that enters Mason Slough, a slough of the Yukon River about 36 airline miles west of Tanana (fig. 1). The creek can be reached by boat on the Yukon River or by pontoon aircraft, which land on the slough. The upper part of the creek is accessible via an old foot and wagon trail that leads up the creek from the mouth (fig. 9).

Mason Creek drains a limited area in the western part of the Gold Hill mining district, which has been a small producer of gold at various times since 1908 (Maddren, 1910, p. 83). Cassiterite is known, or reported, in small amounts in the placer deposits of several creeks in the Gold Hill district, and the first recorded recovery of placer tin in this district was on Mason Creek in 1918 (Martin, 1920). Placer gold mining on this creek was first reported in 1908 (Maddren, 1910, p. 83), and a hydraulic plant was installed in 1917 (Martin, 1919, p. 39). Some gold production has been reported from this creek at various times between 1908 and 1932, and in 1933 it was noted (Smith, 1934, p. 43) that there was no prospecting or mining reported. The only known work on Mason Creek since 1932 was some prospect drilling in 1941-42 near the mouth of Last Chance Creek.

A brief examination of part of the Mason Creek drainage area was made by the writer, assisted by John L. Freeman, camp hand, in July 1944. The work was confined to a traverse of the hills to the west of the creek in an effort to locate a possible bedrock source for cassiterite, and to an examination of the old placer workings just below Henderson Creek (fig. 9) and of several dumps at prospect pits in Mason Creek valley between its mouth and Henderson Creek. No cassiterite was found during these examinations.

GEOLOGY

Bedrock

The bedrock that was examined in the Mason Creek area is medium- to light-gray and silvery quartz-sericite and quartz-chlorite schist, some of which is cut by unmineralized white quartz veinlets and lenses. In thin section the schist is composed predominantly of quartz, light-colored mica or sericite, and chlorite, with a lesser amount of plagioclase. It also contains minor amounts of tourmaline, leucoxene, zircon(?), and apatite(?) in minute crystals. The schist is similar in type and age to that of the Moran Dome area about 18 miles northeast, which is described on p. 14.

On Mason Creek (fig. 9) just downstream from the mouth of Last Chance Creek the foliation of the schist strikes north and dips 50° E. On Mason Slough about half a mile west of Mason Creek the same type of schist is exposed with foliation striking north and dipping 40° E. Another schist outcrop about half a mile farther west shows foliation striking N. 0°-10° E., and has a vertical dip. In this outcrop a number of quartz veins and lenses cut the foliation and joints. There are no undisturbed outcrops on the ridge top west of Mason Creek, but the slabby talus and frost-heaved rubble is entirely of schist with a minor amount of white quartz vein material. Isolated small exposures of schist can be found on the steeper valley wall slopes. No evidence of mineralization, other than quartz, was noted in the outcrops or talus.

Alluvium and Placer Deposits

The creek and placer gravel, which is not delimited on figure 9, consists predominantly of light-gray to silvery quartz-sericite and quartz-chlorite schist with a minor amount of white quartz, and very little fine-grained, green, mafic igneous rock. The coarse gravel is subround and chiefly of pebble and cobble size with only a few boulders 1 to 2 feet in diameter. No mineralization was noted in any of the gravel fragments. Little or no mafic igneous material was noted in the placer gravels downstream from the prospect pit 2 miles upstream from Last Chance Creek.

The placer workings on Mason Creek just below Henderson Creek appeared to have been limited to the present creek gravel deposits, although possibly some bench gravel was mined in these cuts. The mining area was overgrown with small trees and the banks had slumped, and thus it was possible only to estimate roughly the original area and thickness of gravel. According to one report, the gold-bearing gravels at an unknown site on Mason Creek are about 5 feet thick. Martin (1919, p. 39) states that the ground is said to average 12 to 20 feet deep; it is not clear whether this thickness refers to creek or bench ground, and in either case it probably includes both the muck overburden and the gravel. Benches on both sides of the creek at several places below Henderson Creek are reported to consist of washed gravel that is unfrozen. Very little prospecting had been done on them as late as 1917 (Martin, 1919, p. 39). A prospector told the writer in 1943 that most of the bench ground is unfrozen and that all of the gravel in the valley bottom is unfrozen and wet.

Gold is reported to be localized in the bottom few inches of the gravel and in the top few feet of bedrock. It was reported that $700 (old price) in gold was taken out in 1908 on Mason Creek near the mouth of Last Chance Creek, and that sluicing operations on Mason Creek in 1909 yielded as much as $27 (old price) to the shovel (recovery per day per man shoveling into sluice box) in some places. Gold from near the head of Mason Creek was mostly in the form of small rounded pellets about the size of bird shot and had a value of $18.60 (old price) per ounce (Maddren, 1910, p. 83). A prospector told the writer in 1943 that bench ground on the west side of Mason Creek where prospected yielded about 15 cents per square foot in coarse gold, with some richer spots.

The site on Mason Creek from which cassiterite was recovered in 1918 (Martin, 1920, p. 22) is not known. According to an unconfirmed report about one ton of cassiterite-bearing concentrate, which was not assayed or shipped, was recovered from approximately 4,000 cubic yards of gravel. A prospector who had worked on Mason Creek near the mouth of Henderson Creek reported to the writer that a concentrate of a dark heavy mineral with lighter colored spots, presumably cassiterite, was recovered with the gold. This mineral was in such quantity that it interfered with the cleanup of gold from sluice boxes.

Several of the prospect pits and drill holes, and the placer cuts on Mason Creek (fig. 9) between Last Chance and Henderson Creeks were examined in 1944. Dump piles and tailings were panned but no cassiterite and little heavy concentrate were found. Two prospect pits 20 feet apart are located in the bottom of the small tributary valley on the west side of Mason Creek opposite Last Chance Creek. Pan concentrates of the dump material from these pits yielded only two minute flakes of gold. Two lines of holes on 100-foot centers had been drilled across Mason Creek valley, one just below the mouth of Last Chance Creek, and the other about 1,000 feet upstream. The results of this work are not known, but presumably the samples did not encourage further work. A panned sample from the dump of an old prospect pit on the trail of Mason Creek about 2 miles upstream from the mouth of Last Chance yielded no heavy concentrate.

An area of ground, apparently long abandoned, has been worked on Mason Creek just downstream from the mouth of Henderson Creek. Tailing piles from this block of ground, which is about 700 to 800 feet long, at least 100 feet wide, and about 5 to 8 feet deep, were checked by five pan samples. The samples were taken from the sluice box tailraces where the concentration of heavy minerals should be greatest, but very little heavy concentrate was obtained. Two small flakes of gold were found, and cassiterite and magnetite were absent.

Considering the small amount of pan sampling and the type of material available, the absence of cassiterite in the pan concentrates should not be interpreted as positively disproving the reports of placer tin. The prospect pits that were sampled may not have been on a paystreak, and if essentially complete recovery of gold and cassiterite was made in the mining operations, little or no cassiterite would be expected in the tailings. More extensive sampling of gravel collected on or close to bedrock is needed to verify the reported occurrence of placer tin.

PLACER TIN DEPOSITS IN THE RUBY-LONG AREA

By Robert M. Chapman

INTRODUCTION

The Ruby-Long area is on the south side of the Yukon River, by air about 240 miles west of Fairbanks or about 40 miles east of Galena (fig. 1). The Ruby-Long area includes the territory between lat 64°15' N., and the Yukon River, and between long 155°10' and 155°40' W. (fig. 10). Ruby, on the Yukon River, is the only permanent settlement in the area. Long, 28 miles by road south of Ruby, is a nearly abandoned village that is inhabited intermittently by miners and other residents of the area.

Ruby may be reached by airplane or, during the summer months, by riverboat. Long is also accessible by air, or from Ruby by the Ruby-Poorman road, a dirt and gravel road that is generally passable during the summer months. Most of the creeks in the area are accessible from this road by dirt roads, tractor trails, or winter trails.

The forest growth is mainly small spruce, poplar, birch, and alder; most of the higher ridges are covered only by moss and small vegetation. The entire area is blanketed with silt and (or) vegetation; bedrock outcrops are rare, and almost entirely limited to the highest ridge tops, bluffs on the Yukon River, and road and mining cuts.

The low rounded ridges of the area have an average relief of less than 1,000 feet, and a maximum of 1,500 feet. Altitudes range from about 200 feet at the Yukon River to 1,780 feet at Scow Mountain. The topography is in the late mature stage of development with low divides, broad valleys with gently sloping sides and swampy floors, and many meandering streams.

The Ruby-Long area has been examined by several U.S. Geological Survey geologists since 1896. The most comprehensive geological work was done in 1915 by Mertie and Harrington (1924), and in 1933 by Mertie (1936). Placer tin investigations in this area in 1942 were by Robert M. Chapman between August 27 and September 26 under the direction of Robert R. Coats and with assistance during part of the time by Thomas G. Payne, geologist, and W. N. Laval, field assistant. The hospitality and cooperation of many residents of the area are gratefully acknowledged. Work was confined mainly to the valleys of Glacier, Big, Birch, and Midnight Creeks and adjacent divides (fig. 10). Ruby, Flint, Trail, Fifth of July, Short, Flat, and Greenstone Creeks were examined in less detail. Radioactivity reconnaissance examinations were made in July 1949 by M. G. White and J. M. Stevens (1953).

Placer gold mining has been carried on in the Ruby-Long area since 1907 when gold was discovered on Ruby Creek at the town of Ruby (Maddren, 1910, p. 78), but extensive staking of claims and development in the area did not begin until 1910 after gold was discovered on Bear Gulch (Bear Pup), a tributary of Long Creek (Eakin, 1914, p. 43). During the summer of 1942 gold mining was in progress on Long, Midnight, Greenstone, and Trail Creeks, all in the southern part of the area. Nearly all the creeks have been prospected or worked at some time since 1907.

Most of the productive or potentially productive ground in the area was claimed in 1942. The claims on Midnight Creek were owned by Mr. John R. Campbell and the late Mr. Dan McFadden of Long. Some were owned individually and some were held in partnership. The mining in this valley was being done by the Midnight Mining Co., which leased the claims. Mr. William Ahrens of Ruby held two creek and two bench claims on Birch Creek between Straight and Crooked Creeks. Whether other claims were held on this creek is not known, but no work had been done, except by Ahrens, in the previous 20 years. The claims on Big Creek and Cox Pup were held by Messrs. Louis and the late John Pilbach of Ruby. Whether anyone else held claims on this creek is not known. The late Mr. Ernest Warner of Ruby held claims on Glacier Creek in the vicinity of his cabin, 2 miles from the head of the creek, and the late Mr. Carl Bohn was reported to hold some ground near the head of this creek.

Placer mining for gold has been done at various times between 1946 and 1960 on Long, Trail, Midnight, and Greenstone Creeks. In addition, some prospecting or development work has been done on Big and Birch Creeks.

GEOLOGY

Bedrock

Only a brief discussion of the geology of the region is given in this report. More complete discussions may be found in the reports of Mertie and Harrington (1924, p. 12-74), Mertie (1936, p. 130-143), and Eakin (1914, p. 20-27).

Three main types of rock are present in the placer tin localities: (a) a unit predominantly of gabbroic greenstone containing layers and lenses of chert, (b) a unit of predominantly gray to black rocks that are chiefly slate and phyllite but also include schistose facies and some light-gray to brown recrystallized limestone or dolomite, and (c) two small bodies of granite. The metamorphic rocks are of Precambrian or Paleozoic age, and the granite is designated as Jurassic and Cretaceous (Dutro and Payne, 1957). Throughout the area the rocks are transected by veinlets of milky quartz. The surface of the bedrock, recently exposed by mining operations, is decomposed in many places to a sticky clay that ranges in color from white and tan to blue-green and gray.

Greenstone is exposed in mine cuts on Midnight Creek and forms a large part of the float on the divides on both sides of the creek. The fresh rock is light gray green to bluish green and very hard. On weathered surfaces the greenstone is light tan or yellowish and where deeply weathered is dark brown or black and friable. It is jointed and fractured, and in places splits into platy fragments ½ inch to 2 inches thick. Rocks of the slate and schist unit also are exposed in mine cuts on Midnight Creek. They are mostly in the upstream part of the cut, but are interbedded with greenstone in the downstream part. They are soft, break up readily, and range in color from black and gray to blue, green, yellow, and white. Interbedded with them are weathered clayey layers and siliceous and cherty rocks. The lighter colors seem to be caused by intense weathering.

The only known outcrops of granite in the area are on Birch Creek and at the head of Flint Creek. The granite on Birch Creek forms the steep bluff on the east side of the creek opposite the mouths of Straight and Crooked Creeks. It is a light buff-colored, coarse-grained, biotite granite with some porphyritic phases showing feldspar phenocrysts. It is deeply weathered on all exposures. The outcrops at the head of Flint Creek were not visited, but according to Mertie and Harrington (1924, p. 59-60), they are the same type of granite.

Alluvium

The alluvium that fills the valley bottoms of the streams ranges widely in thickness (table 6), type of material, and the content of gold and cassiterite. In most places the alluvium increases in thickness toward the mouths of the creeks. The term "muck" is used locally and in this report to designate the non-gravel overburden. Muck is silt containing vegetal matter and, locally, layers and lenses of peat, ice, and minor amounts of gravel. It is always practically barren of gold and tin (Mertie, 1937, p. 188-189). The muck and gravel, collectively alluvium, are perennially frozen below the depth of seasonal thaw in most of the valleys, except close to the streams.

On some creeks cassiterite and gold are distributed through the total thickness of the gravel, but on others they are localized in the lower part of the gravel or directly on bedrock. The gravel includes material that ranges from fine silt to boulders as much as 1 foot in mean diameter, but the fragments are predominantly of sizes less than 5 inches in mean diameter.

Table 6.--Thickness of muck and gravel in creek valleys in the Ruby-Long area (in feet)

	Creeks							
	Green-stone	Midnight	Trail	Birch 1/	Flat 1/	Glacier 1/	Big 1/	5th of July 1,2/
Muck	3-12	1-20	20-25	30-50				
					14-18	30-70	30-70	60-70
Gravel	1-8	3-30	6	10-40				8-10

1/ Reported by prospectors and miners.

2/ Thicknesses known only near the mouth.

PLACER DEPOSITS

The cassiterite in the placer deposits of the Ruby-Long area is predominantly in grains or fragments of small size ranging from one-sixteenth to one-fourth of an inch in diameter. Some larger nuggets have been found, however, notably on Birch Creek, where the largest one reported weighed about 15 pounds. In the localities where cassiterite is known, cassiterite and gold seem to be closely associated in the gravels. Many of the gold placers, however, do not contain cassiterite; conversely, some of the gravels that do not contain gold may contain cassiterite. Such gravels would have been generally neglected by pioneer miners. The cassiterite and other constituents of the gravel are dominantly subangular, a feature that indicates proximity of the bedrock sources, yet no bedrock source for the cassiterite was found or has been reported. Two explanations for this situation can be offered: either erosion has completely removed the original bedrock source, or the remaining parts thereof are obscured by the thick and widespread cover of muck and vegetation. The cassiterite may have been derived from the quartz veins and fine veinlets that are common in the area and possibly were contemporaneous with the granitic intrusions; it may have come from other undiscovered veins associated with the Mesozoic granitic intrusions; it may have been in the contact zone around the granite masses; or it may have been finely disseminated through the slate and schist. Examination of the quartz veins and of the granite body on Birch Creek showed no evidence of metallization. Several thin sections of impure cassiterite pebbles from Birch Creek show that the fragments consist of cassiterite-bearing quartz vein material.

The distribution of placer tin suggests that the cassiterite bedrock source is not wholly confined to known granitic contact zones. Creek valleys such as Midnight and Birch, which drain a granite contact area, have appreciable cassiterite deposits; however, Flint Creek and the upper part of Greenstone Creek also drain granite contact zones but appear to have only insignificant amounts of cassiterite. Big Creek and Cox Pup valleys do not cross a known granite contact, yet they contain significant amounts of cassiterite. Perhaps a granite body which has not yet been exposed underlies the head of Big Creek, but no indication of this was evident in the field. On Big Creek the gravel on the dump of a placer prospect shaft contained several fragments of vein quartz with tourmaline, a common associate of cassiterite in or near intrusive rocks, but no source of this vein quartz was seen. Granite that crops out in the southern part of the area weathers and breaks up so completely that no granite fragments can be found in the gravel.

Midnight Creek

Midnight Creek (fig. 10) is a southwestward-flowing tributary of Long Creek that is about 6 miles south of the town of Long. It flows in a shallow valley that is approximately 5,000 feet wide between divides and has an alluvial fill 150-250 feet wide in the bottom. The creek flows from the ridge between Long and Flint Creek and has only a few small tributaries. The valley slopes are thinly covered by silt, moss, small brush, and scrub timber. A forest fire in 1940 destroyed a considerable portion of the forest cover in this vicinity.

In the middle and upper parts of the valley of Midnight Creek the muck and gravel are relatively shallow (table 6 and fig. 11), and not difficult to mine. The thickness of muck and gravel varies considerably and in general increases toward the mouth of the creek; a thickness of 80 feet is known about 1.7 miles above the mouth and 125 feet is the postulated thickness at the mouth (Mertie and Harrington, 1916, p. 242-243). Only the deeper parts are perennially frozen, and the frozen gravel will thaw naturally if stripped early in the season. Sufficient water for moderate scale placer mining is usually available in Midnight Creek, and the gradient of approximately 125 feet per mile gives adequate drainage.

The paystreak has not been fully prospected despite the work done in this valley, but without doubt the richer portion of it has been mined. It seems to extend along the south side of the valley adjacent to the creek and is roughly 100 to 150 feet wide. Further prospecting, upstream from the upper dam and downstream from the winter trail, will be necessary before the linear extent of the paystreak can be determined. The areal distribution of the gold and cassiterite is decidedly irregular or spotty, thus making it difficult to sample the paystreak accurately by panning or drilling. The vertical distribution of the valuable minerals appears to be fairly uniform throughout the gravel, and in some of the older workings gold was concentrated on a hard clay false bedrock. Reportedly the yield of gold and tin is greater in the gravels overlying the areas of hard bedrock than in the gravels above the bedrock which has been weathered to clay. Possibly the hard bedrock, which breaks up along joints and fractures, formed an irregular surface and acted as a natural riffle to collect the heavy minerals.

Placer tin was first reported on Midnight Creek in 1912 (Eakin, 1913b, p. 288). In 1917 cassiterite concentrates, weighing 1,037 pounds, that assayed 52.2 percent tin metal (537 pounds) were recovered from 6,000 square feet of bedrock on this creek, and shipped to Singapore (Chapin, 1919). This is the first recorded production from the Ruby-Long area.

Between 1940 and September 3, 1942, cuts were mined that covered 511,800 square feet in area and contained approximately 123,525 cubic yards of gravel. Estimates based on the reported production for the three seasons of mining from 1940 through 1942 indicate that the yield of gold ranges from 23 to 27.5 cents per square foot of bedrock or about $1.10 per cubic yard of gravel. It was reported by the miners that the yield of gold was lowest, probably about 23 cents per square foot, at the upstream and downstream ends of the cuts shown on figure 11.

Approximately 7,320 pounds of cassiterite concentrate was recovered in working these cuts. The quantity of cassiterite lost in the tailings during sluicing could not be determined, but possibly the tailings losses were 25 to 50 percent of the amount contained in the gravel. The cassiterite recovered averaged 0.014 pound per square foot of bedrock or 0.06 pound per cubic yard of gravel. If a content of 70 percent metallic tin is assumed for the cassiterite, 0.01 pound of tin per square foot of bedrock, or 0.042 pound of tin per cubic yard of gravel, was recovered.

A sample of cassiterite concentrate donated by the Midnight Mining Co. assayed 70.24 percent of metallic tin. The gold is reported to have a fineness of 883 to 885.5, but one shipment assayed 857 fine.

Birch Creek

Birch Creek (figs. 10 and 12) is a tributary of Flint Creek and lies about 5.5 miles northeast of Long. It is approximately 8 miles in length and has several tributaries which together drain a large area. The best known tributaries are Straight and Crooked Creeks, which flow eastward, joining Birch Creek about 0.3 mile from each other and 2.5 miles above its mouth. Birch Creek flows in a well-defined valley with a nearly flat floor several hundred feet wide. This valley is from 2 to 3 miles wide between the divides and is 600 to 800 feet deep. The vegetation and forest cover are the same as on Midnight Creek. The muck and gravel on the bench on the west side of the creek are reported to be 40 to 90 feet thick, and are frozen. The volume of water supplied by Birch Creek and its tributaries seems to be adequate for a placer mining operation, and the stream gradient is sufficient to provide drainage.

Gold- and tin-bearing gravel, which also includes some native bismuth, was discovered in 1914 in the valley of Birch Creek (Mertie, 1936, p. 157). Most of the mining and prospecting of this deeply buried gravel was done by underground methods many years before 1942. Thus, it was not possible to obtain through field investigations and talks with miners all the information desired. The thickness of ground and areas worked near the mouths of Straight and Crooked Creeks are shown on figure 12. The paystreak, as known or inferred from actual workings, lies in a gravel bench on the west side of Birch Creek. The top of the bench is 20 to 35 feet above creek level. The muck and gravel on the bench are frozen, except in a few spots and below depths of 80 feet (Mertie and Harrington, 1916, p. 247). The gravel has been worked on lower Straight Creek (Haggstrom), at the mouth of Crooked Creek (Charpie, Ahrens), and about halfway between these points on the bench west of Birch Creek (Jones and Lundin) where probably the richest part of the paystreak lies (fig. 12). It seems reasonable to assume that the paystreak is continuous between these points. Mertie (1936, p. 157) states that operations were carried on as much as 2 miles above Crooked Creek, but nothing is known about gold or tin prospects upstream from Straight Creek, and no workings above Straight Creek were seen by or reported to the writer in 1942.

The quantity of cassiterite reported to have been recovered indicates that the ground contained a minimum of 0.01 to 0.04 pound per square foot of bedrock. Reports of the operations by Jones and Lundin between Straight and Crooked Creeks indicate a yield of 0.5 pound of cassiterite and $0.75 to $1.50 in gold per square foot of bedrock, from about 88,900 square feet of ground mined by underground methods.

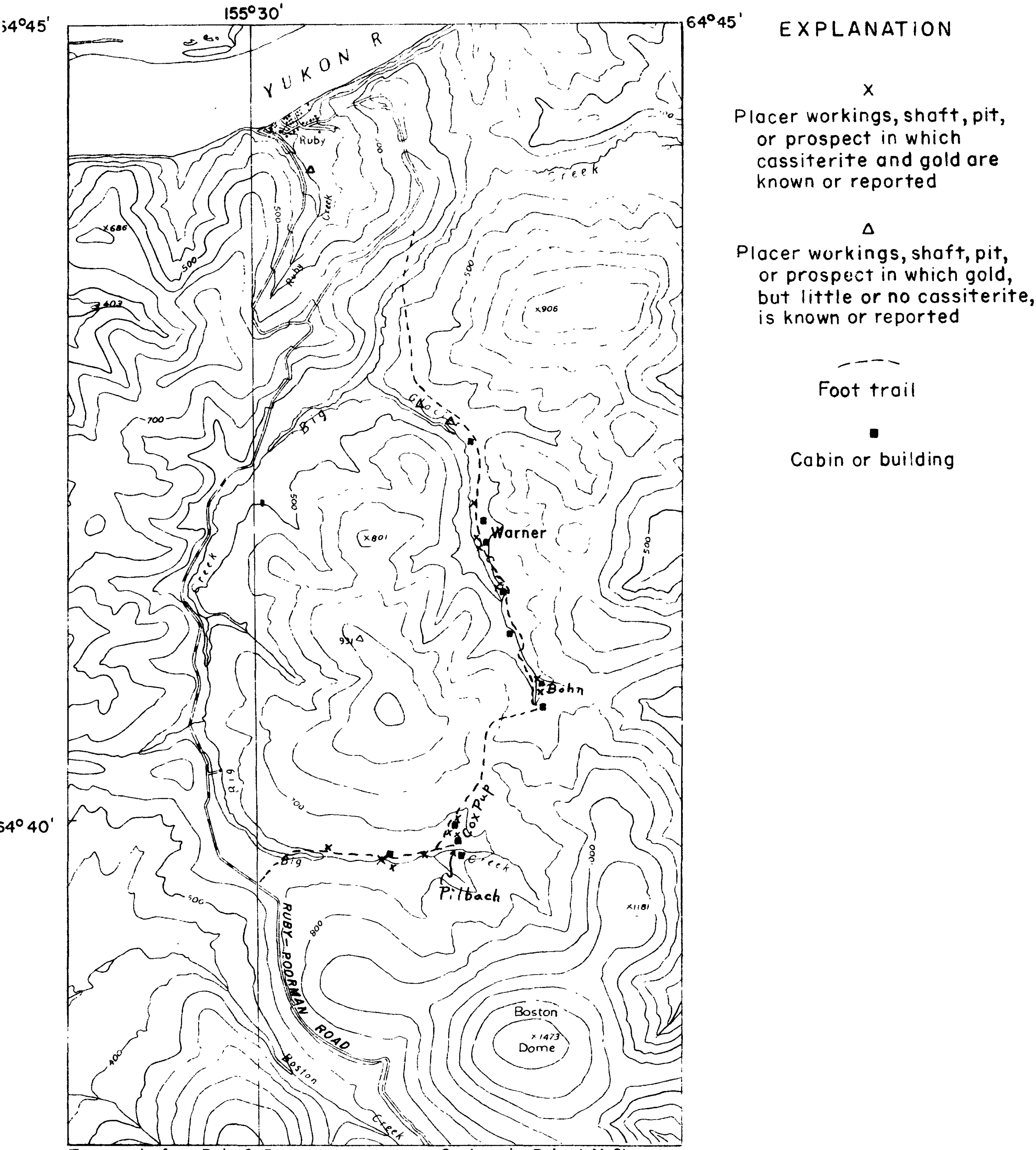
About half a mile downstream from the mouth of Crooked Creek, Birch Creek swings to the extreme south side of the valley, leaving a part of the bench on the north side of the valley. An area of about 26,000 square feet on the bench is reported to have been worked here by Johnson (fig. 12). The paystreak is said to have been mined to a width of 80 to 100 feet, but it is reported to be 50 to 75 feet wider in this area. The full extent of the paystreak up or down the valley is not known. Probably a small paystreak extends up Crooked Creek, as is indicated by some mining which was done several hundred yards up this creek from Birch Creek and also on Lucky Creek, a tributary of Crooked Creek.

The cassiterite from Birch Creek is reported to include the coarsest nuggets in the Ruby-Long area, but nevertheless is predominantly fine. A cassiterite cobble, reported to weigh 15 pounds, was found in 1918 and several other large pieces, one of which weighed 5 pounds, have been reported, but the greater part of the concentrate consists of fragments one-sixteenth to one-fourth of an inch in diameter. Frank Johnson of Long reported that half a ton of cassiterite, having an assay value of 62 percent metallic tin, was recovered in mining 26,000 square feet or 482 cubic yards of gravel on the north side of Birch Creek, half a mile below the mouth of Crooked Creek. It was reported that in 1920 Jones and Lundin recovered 4,000 pounds of cassiterite concentrate by reworking part of a tailing pile on the west side of Birch Creek between Straight and Crooked Creeks that accumulated from working 16,000 square feet of bedrock at this site in 1918. It is estimated that 4,000 pounds of cassiterite remained in the unworked portion of this pile in 1942. The yield of gold in these workings is said to have been 0.39 ounce per cubic yard or $1.18 per square foot of bedrock. Cassiterite was recovered by Ahrens and others who worked on Birch Creek at the mouth of Crooked Creek, but no indication of the amount could be obtained. The yield of gold from Ahrens' workings was reported to be $1.25 per square foot of bedrock and to assay 850 fine. Some cassiterite as well as gold was reportedly found in Haggstrom's workings near the mouth of Straight Creek.

As a bedrock source of the cassiterite could not be found, it is impossible to predict without prospecting whether or not the paystreak is present on Birch Creek above Straight Creek. If the cassiterite is localized along the granite contact between Straight and Crooked Creeks, little or none would be expected upstream from this contact. If the cassiterite was brought into Birch Creek by Straight and Crooked Creeks, however, it would probably be absent from Birch Creek above Straight Creek. The cassiterite could have been derived from veins scattered through the bedrock farther up Birch Creek or also from deposits along the granite contact just north of the mouth of Falls Creek. Pan samples of surficial stream gravel (White and Stevens, 1953, p. 4-5) taken at the mouth of Falls Creek (sample 3455) and from a small creek that drains an area of granite bedrock and enters Birch Creek just above Falls Creek (sample 3456), contain no cassiterite (White, personal communication, 1950); however, surface samples probably do not provide an adequate test for minerals as heavy as cassiterite. Thus drilling is advisable to determine the extent of the paystreak and to help in locating the bedrock source of the cassiterite. No prospecting to determine whether or not deposits exist in the valley floor of Birch Creek was reported. The depth of the ground close to the creek is unknown, and it is likely that much of it is unfrozen. Likewise nothing is known of the extent of the paystreak downstream from Johnson's workings (fig. 12); thus, prospect drilling would be desirable in both of these areas, as it is reasonable to assume that some cassiterite is present. Test drilling and some development work were done in the vicinity of the mouths of Straight and Crooked Creeks between 1946 and 1957, but the extent and results of this work are not known to the writer.

Big Creek

Cassiterite is present in the headwaters portion of Big Creek valley, especially within the area that includes the small tributary stream called Cox Pup or Cox Gulch (fig. 13). Cox Pup lies about 5 miles south of Ruby, or about 1½ miles east of the 7-mile post on the Ruby-Poorman road. Big Creek flows in a wide, shallow valley with very gently sloping sides. The valley is about 1.5 miles wide between the divides, and the floor is approximately 300 feet wide.



Topography from Ruby C-5 and C-6 quadrangles

Geology by Robert M. Chapman and Robert R. Coats, 1942

1:63 360

1 0 1 Mile

FIGURE 13 - MAP OF THE BIG-GLACIER CREEKS AREA SHOWING LOCATIONS OF PLACER TIN PROSPECTS

Contour interval 100 feet

The muck and gravel on Cox Pup were reported by Mr. Louis Pilbach to be about 30 feet in depth, including 15 feet of gravel. In the upper 1.25 miles of Big Creek the muck and gravel were said to range from 15 to 70 feet in depth, and to include 1 to 15 feet of gravel, and earlier reports (Mertie, 1936, p. 145) give a depth of 15 to 60 feet and 1 to 7 feet of gravel. Much of the ground reportedly is not frozen and hence difficult to work by drift mining. Stripping of the overburden and securing drainage on Big Creek would not present problems as the stream gradient is approximately 82 feet per mile. During dry periods, however, it might be difficult to secure enough water for sluicing.

A number of prospect holes have been sunk on this creek, but no estimate of the area or volume of gravel worked could be obtained. Apparently the placer deposits have not been extensively or systematically prospected. In general the paystreak seems to follow the creek, but its exact course has not been fully explored. It is thought to be approximately 30 feet wide and 1,000 feet long on Cox Pup. The paystreak on Big Creek may extend as much as 5,000 feet downstream from Cox Pup and from the meager evidence available is inferred to be 30 feet wide, and to range from 1 to 15 feet in thickness. No information concerning the amount of cassiterite and gold in the gravel of upper Big Creek valley was obtained, but approximately 0.04 pound of cassiterite and 0.0052 ounce of gold per cubic foot can be panned from the dump of almost every prospect hole along the creek.

Gold and cassiterite are reported to be distributed vertically throughout the gravel in the paystreak. Mr. Louis Pilbach saved part of his cassiterite concentrate, about 1,000 pounds, from Cox Pup, and estimated that 400 pounds of it came from 2,000 square feet of bedrock. According to another report, 1,100 pounds of cassiterite concentrate was recovered from working an area of 3,000 square feet. The yield of gold was reported to be about 0.02 ounce or 40 to 60 cents per square foot of bedrock. The cassiterite is largely in the small-pebble- and granule-size range and is subangular and in part crystalline; the gold is generally rough. Tourmaline in quartz pebbles was found on several dump and tailing piles, and most of the gravel is subangular. From all indications the cassiterite, gold, and gravel have not been moved far from their source.

Glacier Creek

Very little is known about the occurrence of tin on Glacier Creek (fig. 13) as that valley has been prospected in only a few places. In the headwaters area where prospecting and mining were done, the muck and gravel are said to be approximately 70 feet deep, and the gravel on the dump piles is composed mostly of medium-crystalline, gray-to-brown limestone or dolomite. About 1 to 2 miles downstream from the headwaters, the paystreak lies in a bench on the east side of the valley. It is estimated that the paystreak is about 10 feet wide, and that the gravel is 2 to 3 feet thick. The valuable minerals are said to be in the bottom 2 feet of the gravel. Prospectors reported that the gravel and muck are 30 to 45 feet deep on this bench and are frozen. The ground in the present creek valley is said to be 20 feet deeper off the edge of the bench, indicating that the gravel bench is underlain by a rock bench. The creek bottom has not been prospected because the ground is unfrozen and very wet, and the sinking of shafts is almost impossible.

The gravels of Glacier Creek contain cassiterite, but no reliable estimate of the amount can be made on the basis of present information. The late Mr. Ernest Warner reported recovery of approximately 150 pounds of cassiterite concentrate from his workings 1.5 miles above the mouth of the creek. The estimated gold yield here was 25 to 30 cents per square foot, but the area worked was not given. Some cassiterite was recovered from the late Mr. Carl Bohn's placer gold workings at the head of Glacier Creek, but no reliable estimates of the amount of gravel worked or the amount of concentrate recovered could be obtained. Cassiterite was panned from two prospect pit dump piles and also reported by Mr. Warner on the bench on the east side of the creek between the workings of Bohn and Warner.

Greenstone Creek

Cassiterite was reported in 1915-1917 (Mertie and Harrington, 1916, p. 243; Chapin, 1919) on Greenstone Creek. Prospecting was done in both the lower and upper parts of the creek during these years, and the exact location of the tin-bearing deposits is not given. Presumably at least some of it was in the block of ground that was dredged in 1916-1917 between 2 and 3.5 miles above the mouth, because Mertie and Harrington suggest that cassiterite may prove to be a valuable accessory mineral in dredging operations. There are no subsequent reports of cassiterite recovery, if any, in the dredging or other mining operations on this creek.

Placer gold mining was being done in 1942 on Greenstone Creek about 1 mile below its head and near the junction of the southwest-trending headwaters tributary gulch and the main valley (fig. 10). The operator, Mr. Asher Richardson, reported that very little cassiterite was found in the placer deposits in this part of the valley, and estimated that he obtained nearly complete recovery of the placer tin, which was about 100 pounds per mining season in the three seasons he had worked here. The gold here is fairly rough, and is associated with only a small amount of "black sand" (chiefly magnetite and ilmenite), compared to the large amounts with the gold and cassiterite placers on Midnight Creek. He stated that the distribution of gold is spotty, which made it difficult to do reliable prospecting in advance of mining.

In 1956 placer ground was being worked on Greenstone Creek about 0.75 mile farther downstream in an area that had been incompletely dredged in 1916-17. The operator, Mr. Clarence Zaiser, reported an appreciable amount of cassiterite in the valley floor and bench that he was working here. The gold is rough and angular, and the cassiterite also is angular. From the lack of rounding of the cassiterite fragments, and the distribution pattern of the cassiterite, it may be inferred that one source of the tin may lie between these two mining areas on Greenstone Creek.

Flat Creek

Flat Creek, a westward-flowing tributary to Long Creek, lies about 1 mile north of Midnight Creek (fig. 10). Very little prospecting or mining was done on this creek prior to 1942 according to Mr. John Campbell of Ruby. To the writer's knowledge no mining was done on this creek between 1942 and 1960. Mr. Campbell guided the writer to some small dump piles at prospect pits dug by Oscar Erickson in 1938 on the south side of the creek about 1.5 miles upstream from the winter trail crossing. He reported that the muck and gravel were 14 feet thick here, and that a small amount of gold and traces of cassiterite were found. No gold or cassiterite was found in pan samples taken from the dumps. Prior to 1938 Mr. Campbell dug a prospect pit about 100 feet north of the creek and a short distance below Erickson's workings in which he reached bedrock at 17 feet. He found no gold or cassiterite here. No other prospects on this creek were seen or reported in 1942. The ground is said to be frozen except close to the creek.

Cassiterite on Flat Creek in the Ruby-Poorman district is reported by Chapin (1919). This is undoubtedly a reference to another Flat Creek, a tributary of Timber Creek about 17 miles south of Midnight Creek and outside of this map area, on which cassiterite is known (Mertie and Harrington, 1916, p. 248).

Short Creek

Placer tin was discovered with the gold on Short Creek in 1913-1915 at workings about 0.6 mile above the mouth. Here, 6 to 8 feet of muck and 4 to 6 feet of gravel were present, and the paystreak was in the bottom foot of the gravel. The cassiterite was finer grained than in most other deposits in this mining district (Mertie and Harrington, 1916, p. 242). No attempt was made in 1915 to save the placer tin, but in 1918 a few thousand pounds of cassiterite was recovered in the gold mining (Martin, 1920, p. 22).

No work was being done on Short Creek in 1942, but the creek had been worked to a width of 20 to 40 feet from just above the winter trail crossing to near the head. Mr. John Campbell reported that a line of drill holes on 30-foot centers across the valley

500 feet below the winter trail yielded no gold or tin. He also stated that the depth to bedrock is 12 feet at the winter trail, 25 to 500 feet below the trail, and about 75 feet near the mouth of the creek.

Fifth of July Creek

Some cassiterite is present in the placer deposits on Fifth of July Creek, but it was not possible to obtain a reliable estimate of the quantity. The late Mr. Chan Walker of Long reported that a washtubful of cassiterite-bearing concentrate, which probably included a considerable amount of limonite fragments, was recovered in working an area of approximately 6,000 square feet, 200 feet below the winter trail crossing. This probably represented incomplete recovery, as the cassiterite clogged the sluice box riffles and no effort was made to save anything but the gold. The gold was said to be very fine, and it had to be amalgamated to separate it from the cassiterite.

The workings near the winter trail crossing on this creek were examined in 1942. Dumps from three prospect pits on the north side of the creek and about 500 feet above the trail crossing include chiefly subangular to subround fragments of greenstone, schist, and quartz, the largest of which are 6 to 7 inches in diameter. Two pan samples from these dumps yielded one small color of gold, no identifiable cassiterite, and a moderate-sized concentrate of "black sand" and limonite pebbles. Six pan samples were taken from tailing piles resulting from mining operations in 1922 by Mr. Chan Walker and located about 150 feet south of the creek and 200 feet downstream from the winter trail. Moderate to large concentrates that included a little sand-sized cassiterite and abundant limonite pebbles and granules were obtained.

The ground, according to Mr. Walker, is 70 to 80 feet deep at the mouth of Fifth of July Creek and includes 8 to 10 feet of gravel. Judging from the size of the dump piles, the ground is at least 30 feet deep near the prospect pits upstream from the winter trail.

Flint Creek

Very little published or reported information is available on the cassiterite content of the placer deposits in upper Flint Creek valley and its tributaries. Mertie (1936, p. 148-149) reports cassiterite in the headwaters tributaries that head against Long Creek. A spectrographic analysis of selected grains from the heavy concentrate of a pan sample (3507) collected in 1949 from stream gravel at the head of Flint Creek showed 0.1 to 1.0 percent tin (White and Stevens, 1953, p. 6-7). Considerable mining and prospecting on Glen Gulch (fig. 13), but no extensive mining on Flint Creek and tributaries above Glen Gulch were done prior to 1933

(Mertie, 1936, p. 158). Apparently little or no work was done on upper Flint Creek between 1933 and 1942, and no work on this creek between 1942 and 1960 is known to the writer. Presumably the lack of reports of appreciable amounts of cassiterite indicates a very small tin content. The geologic setting of this creek in relation to a granite contact zone is similar to that of Birch Creek and, in view of inadequate sampling, the possibility of more placer tin than is now known should not be overlooked.

Only a brief examination of Flint Creek was possible in the time available in 1942. The dump piles from seven prospect pits near the trail crossing 3 miles upstream from Glen Gulch were tested with nine pan samples. One pan concentrate contained three small colors of gold; no coarse cassiterite was found, and some cassiterite may have been present in the finer sand-sized material. The gravel in these dumps was predominantly granite and some quartz.

Trail Creek

Cassiterite is reported in placer deposits on Trail Creek (Chapin, 1919), but Mertie (1936, p. 156-157), who visited the workings in the upper 3.5 miles of the creek in 1933, does not mention cassiterite.

In 1942 T. G. Payne made a brief examination of the placer workings 2 to 2.5 miles below the head of Trail Creek. At that time a cut having an area of about 30,000 square feet had been mined by Messrs. Toyvo Rae, Elmer Koskelo, and Eli Linn. They reported only very small amounts of sand-sized cassiterite in this and other mining cuts. The gold was moderately rough and rather coarse, much of it being one-sixteenth to one-eighth inch in diameter. The largest gold nugget recovered was reported to be worth $93.00. A large amount of pyrite and a small amount of galena were present in the paystreak.

The ground in this vicinity includes 20 to 25 feet of muck and 6 feet of gravel. The gold is in the lowest 2 feet of gravel and in the top foot or so of bedrock, the top 0.5 foot of which is largely weathered to clay. The bedrock is dark-gray schist or phyllite, and the gravel is chiefly pebbles and cobbles of the schist or phyllite and greenstone, with a few granite pebbles.

Other Creeks

Long Creek and its tributaries Bear Gulch (Bear Pup), Fourth of July Creek, Snow Gulch, and Monument Creek were not sampled for placer tin in 1942. Mertie (1936, p. 148) states that considerable amorphous cassiterite, or wood tin, occurs on Long Creek and all of its eastern tributaries where gold placers have been worked. No quantitative estimate of the tin content is given but, according to

Mr. John Campbell and the late Mr. Robert Deacon, who mined on Long Creek for many years prior to 1958, the amount of cassiterite on Long Creek and Bear Gulch is small compared to that on Midnight and Birch Creeks. Mr. Campbell said that only a little cassiterite was found on Monument Creek, and Mertie and Harrington (1916, p. 260) and Chapin (1919, p. 337) only mention that it does occur on that creek. No mention of placer tin on Fourth of July Creek or Snow Gulch was made by any of the local miners in 1942.

Cassiterite on Ruby Creek is reported by Mertie and Harrington (1916, p. 260) and Chapin (1919). The amount of cassiterite is not indicated, and there were no reports of it by local miners in 1942. Pan samples taken from old workings on the creek a short distance above the village of Ruby did not yield any cassiterite. Presumably no appreciable amount of placer tin is present.

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