STUDIES RELATED TO WILDERNESS

PRIMITIVE AREAS

SALMON-TRINITY ALPS, CALIFORNIA

GEOLOGICAL SURVEY BULLETIN 1514

Mineral Resources of Proposed Additions to the Salmon-Trinity Alps Primitive Area, California

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STUDIES RELATED TO WILDERNESS
PRIMITIVE AREAS

In accordance with the provisions of the Wilderness Act (Public Law 88-577, September 3, 1964) and the Conference Report on Senate bill 4, 88th Congress, the U.S. Geological Survey and the U.S. Bureau of Mines are making mineral surveys of wilderness and primitive areas. Areas officially designated as "wilderness," "wild," or "canoe" when the act was passed were incorporated into the National Wilderness Preservation System. Areas classed as "primitive" were not included in the Wilderness System. The mineral surveys constitute one aspect of the suitability studies. This report discusses the result of a mineral survey of five proposed additions to the Salmon-Trinity Alps Primitive Area, California, that may come under discussion when the area is considered for wilderness designation.

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MINERAL RESOURCES OF PROPOSED ADDITIONS TO THE SALMON-TRINITY ALPS PRIMITIVE AREA, CALIFORNIA

By PRESTON E. HOTZ and ROBERT C. GREENE, U.S. GEOLOGICAL SURVEY, and TERRY J. CLOSE and ROBERT K. EVANS, U.S. BUREAU OF MINES

SUMMARY

A mineral survey of five areas totaling 80 square miles, not included during the 1968–70 examination of the proposed Salmon-Trinity Alps Wilderness, was made by the U.S. Geological Survey and U.S. Bureau of Mines in 1973. U.S. Geological Survey personnel mapped the geology and collected stream-sediment and rock samples for spectrographic and chemical analysis; U.S. Bureau of Mines personnel examined the known placer and lode claims. The areas examined include: (1) the upper drainage of Red Cap Creek in Humboldt County, adjoining the northwest part of the Salmon-Trinity Alps Primitive Area; (2) an area in Trinity County south of the primitive area including the drainage of Big French Creek and the canyon of North Fork Trinity River from Hobo Gulch Forest Camp to the junction with East Fork of North Fork Trinity River; (3) an area, also south of the primitive area and in Trinity County, including East Fork of North Fork Trinity River from Manzanita Flat to Squaw Gulch, and the drainage of Indian Creek, Squaw Gulch, lower East Branch, and lower Yellow Jacket Creek; (4) the drainage of St. Clair Creek in Siskiyou County north of the primitive area; and (5) a small area on New River from the junction of Slide and Virgin Creeks downstream to the mouth of Barron Creek that was previously mapped by the U.S. Geological Survey (Hotz and others, 1972) but had not been studied by the U.S. Bureau of Mines.

The area west of Red Cap Creek is underlain by granitic rocks, including pyroxene diorite and syenodiorite. East of Red Cap Creek the country rocks are predominantly metasedimentary rocks of the western Paleozoic and Triassic belt (Irwin, 1966), including argillite and quartzite, minor conglomerate and graywacke, and discontinuous lenticular limestone bodies; less abundant are fine-grained metavolcanic rocks. Small plutons of gabbro and rare quartz latite porphyry intrude the metasedimentary rocks. Discontinuous slivers of serpentinite occur along a fault of regional extent.

In the Big French Creek drainage the country rocks are fine-grained metasedimentary rocks intruded by small plutons of quartz diorite and gabbro. The Twin Sisters fault zone is the eastern limit of the metasedimentary rocks. Metavolcanic rocks and a belt of gabbro lie between the Twin Sisters fault zone and the North Fork fault zone in the North Fork Trinity River canyon. Serpentinite occurs in both fault zones but is most continuous along the North Fork fault. A narrow belt of metasedimentary rocks including mainly recrystallized chert, argillite, and minor siltstone lies east of the North Fork fault and is overridden by the Salmon Hornblende Schist along a thrust fault whose trace is approximately along the East Fork of North Fork.

St. Clair Creek is underlain by metasedimentary rocks including metamorphosed limestone, chert and siltstone, and some interbedded fragmental and vesicular metavolcanic rocks. A prominent marble bed makes up Limestone Ridge, west of St. Clair Creek.

Small quantities of copper, lead, and zinc were detected in many of the samples collected from all of these areas for the geochemical study. Some samples contained anomalously high quantities of copper, zinc, and molybdenum, but no consistent patterns were revealed that might indicate undiscovered concentrations of economic importance. Some of the sediment samples contained anomalous amounts of chromium and nickel, contributed from the local mafic and ultramafic country rocks in which these elements are relatively abundant; however, no economic deposits of these metals were found by this survey. Four rock samples collected contained a trace of gold, and two contained traces of silver.

The areas examined have no recorded history of mineral production, but based on the volume of gravel that has been mined and an average grade calculated from the results of this sampling study, as much as 11,000 oz of gold may have been produced from small placers along the North Fork of Trinity River, the East Fork of North Fork, and New River. A few prospects on lode claims are known but have no recorded production. However, from 1889 until 1941, the Yellowstone and Enterprise-Lone Jack mines on East Fork of the North Fork near the study area boundary produced more than $500,000 worth of gold, silver, lead, and copper.

Gravel deposits in the study area have been mined for gold by small-scale methods, such as ground sluicing and hydraulicking. Small portable suction dredges are presently used to mine stream-channel placer gravels on North Fork Trinity River, the East Fork of North Fork, and on New River. Stream channel deposits in these areas, estimated to total 3,004,000 cubic yards (2,297,000 m^3) are paramarginal resources with an estimated average grade of 50 cents/yard at a gold price of $150 per troy ounce. However, samples taken on bedrock averaged $3.05 per yard. About 15 percent of this gravel is estimated to be minable by selective methods where the gravels contain over 85 cents in gold per cubic yard. Bench, or stream terrace, deposits are estimated to total 749,000 cubic yards (573,000 m^3), with an average grade of 66 cents per cubic yard. The bench placers are minable by hydraulic or mechanical transport methods with subsequent concentration in sluice boxes if the gravel averages 55 cents in recoverable gold per cubic yard under present operating conditions (1974).

The known lode deposits of the proposed additions are in areas drained by upper Red Cap Creek, North Fork Trinity River, and East Fork of North Fork. The indicated

submarginal lode resources are 14,000 tons (12,600 tonnes) containing from about 0.03 to 0.2 oz gold per ton (1–7 g per tonne) and averaging 0.1 oz per ton (3.0 g per tonne). They also contain about 0.1 to 0.2 oz silver per ton (3–7 g per tonne), and a trace of lead. Although gold content as high as 0.48 oz per ton (16 g per tonne) has been found, the erratic distribution of known high grade in small bodies coupled with their remote location indicates that significant amounts of metal would not be produced. However, further exploration might disclose minable deposits.

Limestone is the only nonmetallic commodity of possible economic interest in any of the areas examined, but because of its distance from markets, it is not likely to be of economic importance. The study areas have no potential for combustible fuels, and no potential for geothermal energy.

INTRODUCTION

During the summer of 1973, at the request of the U.S. Forest Service, the U.S. Geological Survey and the U.S. Bureau of Mines studied five areas in the proposed Salmon-Trinity Alps Wilderness (fig. 1) which were not included in an earlier examination made in 1968–70 (Hotz and others, 1972). The additional areas contain approximately 80 square miles (207 km^2), or 51,300 acres (20,760 hectares). The areas studied (fig. 1) are (1) area LL, the upper Red Cap Creek drainage, which is essentially the same as U.S. Forest Service proposed addition D; (2) area MM, which includes parts of the U.S. Forest Service proposed addition C not included in the 1968–70 study—it encompasses the southern part of the North Fork Trinity River drainage and upper Big French Creek drainage; (3) area NN, a small part of U.S. Forest Service addition B not previously studied, which includes the East Fork of North Fork Trinity River and its tributaries Indian Creek and Squaw Gulch and the lower end of East Branch and Yellow Jacket Creek; (4) the upper part of St. Clair Creek, here designated area OO, which is part of U.S. Forest Service addition E, most of which was included in the earlier study; and (5) a small area on New River, designated E, downstream from the junction of Slide and Virgin Creeks.

Investigations in the study areas by the Geological Survey included reconnaissance geologic mapping and the collection of stream-sediment and rock samples for geochemical analysis. The field studies were made by P. E. Hotz and R. C. Greene, ably assisted by R. C. Evarts and S. P. Galanis, Jr. The samples were analyzed in Geological Survey mobile field laboratories under the direction of D. J. Grimes.

Investigations by the Bureau of Mines were concerned mainly with the economic aspects of the mineral resources. Data on lode and

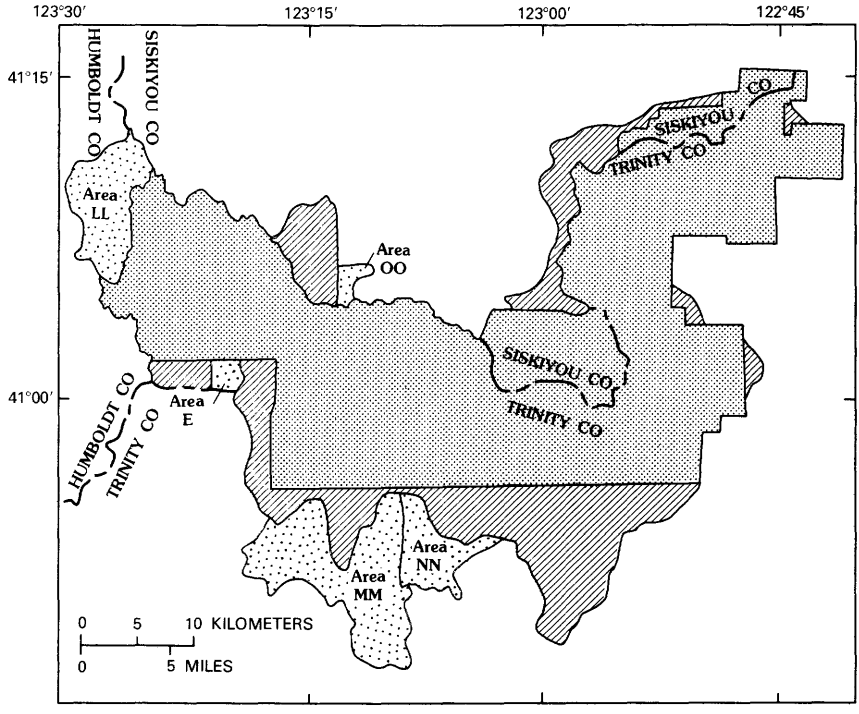

FIGURE 1.—Salmon-Trinity Alps Primitive Area (shaded) and additional study areas (line pattern) described by Hotz and others (1972), and proposed additions (dot pattern) described in present report.

placer mining claims were obtained from the records of Trinity County in Weaverville, Siskiyou County in Yreka, and Humboldt County in Eureka. The placer and lode mining claims were mapped and sampled. Placer samples taken from trenches or from gravel near bedrock exposures were concentrated in the field by panning or in a sluice box and further concentrated on a Wilfley table. Gold content of the samples was determined by weighing the handpicked and amalgamated gold. Lode samples taken from mineralized structures and mine dumps were assayed for gold and silver. Selected lode and placer samples were analyzed spectrographically to check for other elements of possible economic importance.

The field examinations of known claims were made by Terry J. Close and Robert K. Evans, assisted by Rick Standish, Don Smith, Jim Krause, Don Heady, Dalton Smith, and Bill Marratt. Approximately 295 man-days were spent by U.S. Bureau of Mines personnel in field investigations.

It is a pleasure to acknowledge the cooperation and assistance af-

forded the field parties by officers of the U.S. Forest Service Big Bar and Weaverville Ranger Districts, Shasta-Trinity National Forest. The U.S. Bureau of Mines appreciates the cooperation of local residents who aided in the studies, particularly the Virgil Horn, Edgar Patton, and Melvin Jones' families and Elmer Bolt, Emery Beattie, and Rex McGee.

GEOLOGIC APPRAISAL

By PRESTON E. HOTZ and ROBERT C. GREENE

GEOLOGY

The regional geology of the Salmon-Trinity Alps Primitive Area has been described previously (Hotz and others, 1972) and need not be repeated here. The areas investigated (pl. 1) for this study are underlain by rocks of the western Paleozoic and Triassic belt (Irwin, 1966), except area NN which is in the central metamorphic belt (Irwin, 1966). Lenticular bodies and narrow tabular masses of serpentinite are common. Small to moderate size granitic and gabbroic plutons are common, and the eastern part of a large granitic pluton occurs in area LL.

AREA LL

Area LL, embracing the upper Red Cap Creek drainage northwest of the existing primitive area, is in Humboldt County, west of the prominent ridge known as Devils Backbone; it is exceedingly rugged terrain with as much as 5,000 ft (more than 1,500 m) of relief.

Most of the area west of Red Cap Creek is underlain by metavolcanic and metasedimentary rocks that are intruded by small granitic and gabbroic plutons. The granitic rock west of Red Cap Creek is the eastern part of a large pluton, the Ironside Mountain batholith. Specimens collected from this pluton include both pyroxene diorite and syenodiorite. The contact with metavolcanic rocks in approximately along Red Cap Creek in the southern three-quarters of the area where strong shearing and alteration at several places indicates that the contact is faulted.

The rocks east of Red Cap Creek have a beltlike arrangement with metavolcanic rocks on the west overlain on the east by fine-grained sedimentary rocks. The metavolcanic rocks are fine-grained flows and fragmental rocks that have been metamorphosed to greenish-gray rocks composed mainly of sodic plagioclase, actinolite, and chlorite, with various amounts of accessory epidote or clinozoisite, sphene or leucoxene, and magnetite or magnetite-ilmenite. The overlying

sedimentary rocks are mostly dark-gray and brownish-gray to black fine-grained argillite and dark fine-grained quartzite, with minor interbedded chert-argillite conglomerate and graywacke. Small lenticular bodies of limestone, mostly recrystallized to marble, occur in a few places; for example, near Onemile Camp and in an area three-quarters of a mile (1.2 km) west of Eightmile Camp.

About midway between Salmon Mountain and Red Cap Creek a body of pyroxene hornblende gabbro intrudes metasedimentary and metavolcanic rocks. Another smaller pyroxene gabbro pluton northwest of Salmon Mountain intrudes metavolcanic rocks. It should be noted here that the elongate body on Devils Backbone between Eightmile Camp and Onemile Camp was erroneouly called gabbro, at least in its southern part, on the geologic map accompanying Geological Survey Bulletin 1371–B (Hotz and others, 1972, pl. 1). Recent fieldwork and thin section studies show that these are fine-grained, commonly porphyritic, mafic metavolcanic rocks.

An unusual variety of rock makes up the topographic feature known as Indian Rocks, between Whiteys Peak and Salmon Mountain. A dike intruded along the contact between a lenticular serpentinite body and metasedimentary rocks is composed of a distinctive dacite or quartz latite porphyry composed of large white plagioclase phenocrysts and less abundant pink rounded phenocrysts of garnet, in a groundmass which is itself a porphyry composed of small phenocrysts of black hornblende and clear subhedral to rounded quartz in a microcrystalline groundmass. The small bodies of serpentinite which occur here and west of Eightmile Camp possibly are situated along an extension of the fault that crops out on Devils Backbone south of Eightmile Camp and in the valley of Eightmile Creek.

AREA MM

Area MM, which includes the southern half of North Fork Trinity River and its tributaries and the drainage of French Creek, is rugged and access is difficult. A reconnaissance survey of the eastern two-thirds of the area was previously made by Cox (1967). Traverses in some previously inaccessible parts of the North Fork canyon and the use of color aerial photographs have permitted some refinements in the geology, but there are no important differences from the mapping of Cox.

The geologic units and major structures previously described in the study area to the north (Hotz and others, 1972) continue southward in area MM. In the central and eastern two-thirds of the area two major fault zones, the Twin Sisters fault zone and the North Fork fault zone,

converge southward. The Twin Sisters fault zone is west of Limestone Ridge and Twin Sisters Mountain; the North Fork fault zone is in the canyon of North Fork of Trinity River. The terrain between the fault zones is underlain by a tabular gabbroic body and a belt designated on plate 1 as metavolcanic rocks which includes diabase, fragmental metavolcanic rocks, and metabasalt flows and pillow lava. The gabbro is truncated by the North Fork fault zone. Metasedimentary rocks, including argillite and chert-argillite breccia and interbedded chert, quartzite, and scattered lenticular limestone, occur west of the Twin Sisters fault zone, in the French Creek drainage. East of the North Fork fault zone, a narrow belt of metasedimentary rocks composed mainly of fine-grained recrystallized, rhythmically bedded chert, argillite, and metasiltstone and minor amounts of chert-argillite breccia and rare limestone underlies Backbone Ridge. To the east, in the valley of East Fork of North Fork Trinity River, this belt of metasedimentary rocks is overthrust by the Salmon Hornblende Schist (Devonian).

Plutonic rocks of unknown composition intrude metasedimentary rocks in the lower part of Big French Creek and on Brushy Mountain. Biotite-hornblende quartz diorite crops out on the upper part of Brushy Mountain and is exposed along a jeep road on the east side of Brushy Mountain. In the lower part of Big French Creek and the southern slopes of Brushy Mountain, dark hornblende quartz diorite and some hornblende-pyroxene gabbro crop out.

AREA NN

Area NN, which includes Indian Creek and Squaw Gulch and the high ridge between East Fork of the North Fork Trinity River and the valley of Canyon Creek, is entirely underlain by the Salmon Hornblende Schist. This is a very uniform lithologic unit composed of foliated fine-grained albite-epidote amphibolite. North of here, in Yellow Jacket Creek and East Branch, several small inactive gold mines and prospects are located on quartz veins in the hornblende schist (Hotz and others, 1972, p. 104–112). Some small unmineralized quartz veins were seen in area NN.

AREA OO

Area OO, north of the boundary between Trinity and Siskiyou Counties, includes the valley of St. Clair Creek. The area is in the western Paleozoic and Triassic belt which here includes limestone, chert, metasiltsone, and some interbedded metavolcanic rocks. The metavolcanic rocks are commonly vesicular and fragmental, with a

calcareous matrix. Fine-grained hornblende andesite dikes are plentiful. A striking feature of this area is a prominent bed of marble that makes up Limestone Ridge west of St. Clair Creek. The east-dipping bed crops out along the ridge and down the steep eastern slope into St. Clair Creek.

GEOCHEMICAL STUDIES

One hundred and twenty samples, including 68 stream-sediment and 52 rock samples, were analyzed by semiquantitative spectrographic, atomic absorption, and colorimetric methods. The analytical data are contained in table 1. The sampling and analytical procedures are the same as those used in the previous study (Hotz and others, 1972, p. 24), except that in the present study no panned concentrates of stream sediments were taken.

AREA LL

Seventeen stream-sediment samples from Red Cap Creek and its tributaries and 17 rock samples were collected in area LL (fig. 2). A few sediment samples show slightly anomalous values for citrate-soluble combined heavy metals (CxHM) and for molybdenum, but there are no indications of unusual upstream concentrations. One of the rock samples (22) contained a trace of gold. This sample was vein quartz containing minor amounts of sulfide from the dump of a caved adit on the east side of Devils Backbone approximately half a mile (0.8 km) south of Whiteys Peak. Samples 20 and 21 from shear zones in the south wall of a cut at the same prospect contained no detectable gold. Sample 28, iron-stained metavolcanic rock from the west side of Devils Backbone, contained a trace of silver and a relatively high concentration of strontium. Sample 31, which contains an unusual concentration of zinc (300 ppm), was from an 8-ft-wide (2.4 m) alteration zone in marble.

AREA MM

Samples from area MM included 39 sediment and 31 rock samples (fig. 3). A scattered few of the sediment samples contain slightly higher than background amounts of copper, zinc, and citrate-soluble combined heavy metals (CxHM). One rock sample (70) contained detectable silver and a trace of gold. This was a grab sample of milky quartz with some greenish mica collected from the dump of a small caved adit on the Waldorff Trail (SE¼ sec. 32, T. 35 N., R. 11 W.). One (38) of four samples from the Busted Shoestring prospect (northern

part sec. 30, T. 35 N., R. 11 W.) on the trail to Raymond Flat also contained a trace of gold. Two other samples from this prospect (36 and 37) were relatively rich in barium, copper, and zinc. Small amounts of sulfide minerals, chiefly pyrite and a little chalcopyrite, occur in some specimens from this locality. A sample of iron-stained thin-bedded chert (1) exposed in the bank of the jeep road near Stove Camp, Ironside Mountain quadrangle, contained a trace of gold. Although a few rock samples contain anomalous quantities of some metals, in general, the rock samples are not indicative of unusual concentrations of metals.

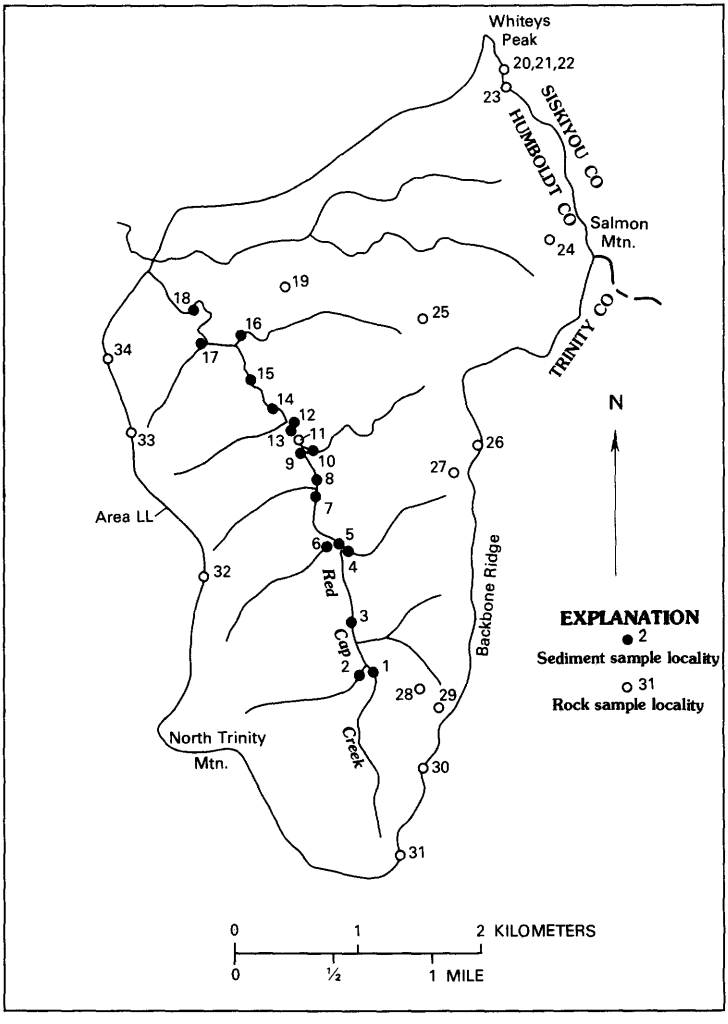

FIGURE 2.—Sample locations in area LL.

TABLE 1.—*Analyses of samples from the*

[Semiquantitative spectrographic analyses are reported to the nearest number in the series 1, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, and so forth, which represents approximate midpoints of group data on a geometric scale. In addition to elements shown, all samples were analyzed for As, Be, Bi, Cd, La, Nb, Sb, Sc, Sn, W, and Y, which were either not detected or showed no significant values and are not shown. Sediment samples analyzed by colorimetric methods for citrate soluble combined heavy metals and copper are shown as cxHM and cxCu. Atomic absorption detection analyses for Cu and Zn in stream sediments and for Au in rock samples are labeled AA. Hg determinations by

Sample	Semiquantitative spectrographic analyses												
	(percent)		(ppm)										
	Fe (0.05)	Ti (0.002)	Mn (10)	Ag (0.5)	B (10)	Ba (20)	Cu (5)	Cr (5)	Cu (5)	Mo (5)	Ni (5)	Pb (10)	Sr (100)
AREA LL													
Stream sediments													
1	7	0.7	1,500	N	30	300	50	200	100	5	70	15	500
2	7	.7	1,500	N	30	300	20	70	70	10	L	10	300
3	5	.5	1,000	N	30	500	30	70	100	N	20	15	500
4	5	.3	700	N	20	200	20	300	100	N	70	10	200
5	15	G(1)	2,000	N	L	70	50	300	50	20	30	N	150
6	7	.5	1,500	N	L	300	30	100	100	5	30	10	300
7	7	.5	1,500	N	30	300	30	100	100	N	30	10	500
8	7	.5	700	N	30	300	30	100	50	N	30	10	500
9	10	1	1,000	N	20	300	30	200	70	7	30	10	300
10	2	.15	300	N	N	100	10	200	20	N	100	N	100
12	7	.5	700	N	30	300	30	500	50	N	70	15	300
13	7	.5	700	N	20	200	30	150	70	N	30	N	200
14	10	.7	1,500	N	10	150	50	700	70	10	50	N	200
15	7	.5	700	N	10	150	20	150	50	N	30	L	200
16	7	.3	1,000	N	20	150	50	700	50	N	100	10	300
17	10	.7	1,500	L	20	300	70	300	150	5	70	10	300
18	7	.5	1,000	N	20	300	30	200	70	L	70	10	300
Rock samples													
11	5	0.3	500	N	20	300	15	70	30	N	15	15	500
19	3	.3	700	N	N	5,000	20	150	70	N	30	L	500
20	7	.3	700	N	15	200	30	500	100	7	100	L	200
21	5	.3	1,000	N	20	70	30	300	150	N	100	L	500
22	.1	.015	50	N	10	N	N	L	10	N	L	50	N
23	5	.3	200	N	20	150	7	150	70	N	50	L	100
24	7	.5	1,000	N	L	200	30	200	150	5	70	L	300
25	7	.3	700	N	N	70	50	50	70	N	20	L	200
26	7	.3	1,500	N	70	500	50	50	70	N	50	10	700
27	5	.3	1,000	N	20	700	15	300	70	N	30	15	500
28	7	.5	1,500	0.5	30	300	10	100	70	N	7	10	1,000
29	5	.5	700	N	20	150	30	300	200	N	50	L	300
30	7	.5	1,500	N	50	200	20	500	30	N	100	15	300
31	7	.7	1,000	N	20	70	30	200	50	N	100	20	500
32	5	.3	1,000	N	15	150	15	L	50	N	L	10	300
33	3	.15	500	N	N	200	15	15	50	N	L	N	200
34	7	.3	1,000	N	20	300	30	100	150	N	20	N	500
AREA MM													
Stream sediments													
2	3	0.3	700	N	70	300	20	300	30	N	100	15	L
3	3	.3	700	N	50	300	20	300	30	N	100	15	L
7	5	.3	700	N	20	150	30	2,000	30	N	100	N	150
8	5	.5	1,000	N	30	200	50	1,000	50	N	100	10	200
9	7	.5	1,000	N	30	300	30	300	30	N	70	10	300
10	5	.5	1,000	N	30	300	50	500	70	N	150	10	150
11	3	.5	700	N	20	200	30	1,500	30	N	150	L	100
12	5	.5	700	N	100	300	30	700	50	N	150	10	150
20	10	1	1,000	N	N	70	70	2,000	50	N	150	N	150
26	7	.5	700	N	L	150	50	700	30	N	150	L	150
27	7	.7	1,000	N	10	100	50	1,500	30	N	150	L	150
28	7	1	1,000	N	15	200	50	1,500	30	N	150	N	200
29	7	.7	1,000	N	10	100	50	1,000	30	N	100	N	150
30	7	.7	1,000	N	20	30	50	700	50	N	70	10	200
31	5	1	1,500	N	L	70	50	500	50	N	150	L	200

See footnotes at end of table.

Salmon-Trinity Alps Primitive Area, California

instrumental methods on rock samples are shown as Inst. Numbers in parentheses indicate lower limits of determination in parts per million. Symbols used are ----, not looked for; N, looked for but not detected; G, the amount present is greater than the sensitivity limit; L, the element was detected by was below the determination limit; INS, insufficient sample. Semiquantitative spectrographic analyses were by D. J. Grimes. Atomic absorption analyses for Au, instrumental determinations of Hg, and colorimetric determinations of cxHM and cxCu were by J. D. Hoffman. Atomic absorption analyses for Zn and Cu were by R. M. O'Leary and M. S. Erickson]

Sample	Semiquantitative spectrographic analyses—Continued (ppm)			Chemical analyses AA (ppm)			Inst (ppm)	Colorimetric (ppm)		Sample description [1]
	V (10)	Zn (200)	Zr (10)	Au (0.02)	Cu (10)	Zn (25)	Hg (0.01)	cxHM (0.5)	cxCu (1)	
AREA LL										
Stream sediments										
1	300	N	100	----------	95	100	------	14	N(1)	----------
2	500	N	700	----------	85	50	------	5	3	----------
3	200	N	150	----------	120	80	------	4	3	----------
4	150	N	70	----------	120	120	------	20	5	----------
5	700	N	1,000	----------	40	30	------	2	5	----------
6	300	N	70	----------	100	80	------	5	1	----------
7	200	N	100	----------	110	65	------	3	1	----------
8	200	N	50	----------	70	55	------	2	3	----------
9	300	N	200	----------	90	55	------	1	2	----------
10	100	N	30	----------	55	60	------	2	N(1)	----------
12	200	N	100	----------	40	55	------	2	N(1)	----------
13	200	N	100	----------	70	70	------	3	L(1)	----------
14	300	N	200	----------	65	40	------	2	2	----------
15	200	N	70	----------	65	50	------	2	N(1)	----------
16	200	N	50	----------	50	45	------	2	L(1)	----------
17	300	N	150	----------	100	65	------	3	1	----------
18	200	N	150	----------	70	55	------	3	L(1)	----------
Rock samples										
11	100	N	100	N(0.05)	------	------	0.04	------	------	5 ft FeOx st shear zone.
19	100	N	100	N(.05)	------	------	L(.02)	------	------	FeOx st mv.
20	200	N	70	N(.05)	------	------	.04	------	------	Shear zone, prospect trench.
21	200	L	70	N(.05)	------	------	.06	------	------	Shear zone, prospect trench.
22	5	N	N	.95	------	------	.12	------	------	Vein qtz float, prospect trench.
23	200	N	100	N(.05)	------	------	.30	------	------	FeOx st, py mv.
24	100	N	100	N(.05)	------	------	.02	------	------	FeOx st, py mv.
25	200	N	30	N(.05)	------	------	L(.02)	------	------	Py-bearing tactite.
26	300	N	70	N(.05)	------	------	.04	------	------	FeOx st arg, minor py.
27	200	N	70	N(.05)	------	------	.02	------	------	FeOx st arg, minor py.
28	300	N	100	N(.05)	------	------	.06	------	------	FeOx st mv.
29	100	N	70	N(.05)	------	------	.04	------	------	FeOx st mv.
30	100	N	70	N(.05)	------	------	.02	------	------	FeOx st mv.
31	200	300	100	N(.05)	------	------	L(.02)	------	------	8 ft alt zone in marble.
32	100	N	100	N(.05)	------	------	.02	------	------	Sheared, alt gr rk.
33	100	N	N	N(.05)	------	------	.10	------	------	Slightly alt gr rk.
34	200	N	50	N(.05)	------	------	.08	------	------	FeOx st gr rk.
AREA MM										
Stream sediments										
2	100	N	100	----------	40	110	------	4	N	----------
3	100	N	70	----------	45	110	------	2	N	----------
7	200	N	50	----------	55	65	------	3	2	----------
8	300	L	100	----------	60	90	------	14	3	----------
9	500	L	100	----------	35	85	------	17	N	----------
10	200	L	70	----------	70	130	------	20	3	----------
11	150	N	70	----------	55	120	------	4	L	----------
12	200	300	100	----------	INS	INS	------	50	N	----------
20	200	N	50	----------	35	20	------	3	N	----------
26	200	N	50	----------	35	30	------	3	N	----------
27	200	N	150	----------	40	30	------	3	N	----------
28	300	N	150	----------	35	30	------	3	N	
29	200	N	100	----------	30	30	------	2	N	----------
30	200	L	70	----------	INS	INS	------	INS	INS	----------
31	300	N	70	----------	35	30	------	1	N	----------

TABLE 1.—*Analyses of samples from the*

Semiquantitative spectrographic analyses

Sample	(percent)		(ppm)										
	Fe (0.05)	Ti (0.002)	Mn (10)	Ag (0.5)	B (10)	Ba (20)	Cu (5)	Cr (5)	Cu (5)	Mo (5)	Ni (5)	Pb (10)	Sr (100)
AREA MM													
Stream sediments													
32	7	1	1,500	N	15	100	50	1,500	50	N	150	L	200
33	5	.5	1,000	N	L	150	30	1,000	50	N	150	L	150
34	5	.5	1,000	N	15	30	50	700	100	N	150	L	200
35	5	.5	1,000	N	L	100	50	1,000	30	N	150	N	100
41	5	.7	1,000	N	L	100	50	500	30	N	150	N	150
42	5	.5	700	N	20	50	50	1,000	70	N	100	N	150
44	5	.7	1,500	N	30	50	50	150	200	N	70	N	150
45	5	.7	1,000	N	20	150	50	1,500	50	N	150	N	200
46	7	.5	1,000	N	20	30	70	1,000	100	N	300	L	150
47	5	.5	700	N	15	50	30	700	70	N	150	L	150
48	10	1	1,500	N	L	70	70	2,000	50	N	150	N	100
50	7	1	1,000	N	L	100	50	700	50	N	150	L	200
51	7	.7	1,000	N	L	100	50	1,500	30	N	150	N	150
52	7	1	1,500	N	L	150	70	700	50	N	200	N	200
53	3	.5	200	L	50	500	15	200	30	N	150	15	N
54	3	.3	300	N	50	500	15	200	50	N	150	L	L
55	3	.2	300	N	15	300	20	500	20	N	200	L	N
56	7	1	1,500	N	N	100	50	1,500	30	N	150	N	200
58	5	.7	1,000	N	L	100	30	1,000	70	N	100	N	200
59	7	.7	1,000	N	20	150	50	1,000	50	N	200	N	200
60	7	.7	700	N	20	100	50	1,000	70	N	150	10	100
61	5	.7	1,000	N	10	100	50	700	50	N	150	L	150
62	5	.5	700	N	20	100	50	500	70	N	150	10	L
63	5	.5	700	N	20	30	30	500	30	N	200	N	100
Rock samples													
1	5	0.15	200	N	30	200	10	50	100	10	50	L	N
4	7	.3	700	N	30	300	30	300	50	N	100	N	300
5	7	.7	500	N	200	300	30	200	50	N	70	10	N
6	7	.3	1,000	N	15	300	50	70	20	N	7	L	500
13	7	.2	300	N	70	300	20	50	200	30	100	20	N
14	.5	.007	70	N	N	20	N	N	N	N	N	L	N
15	10	.5	1,000	N	20	70	70	150	100	N	70	L	300
16	.15	.005	70	N	N	N	N	L	L	N	N	10	N
17	10	.5	200	L	N	30	N	10	150	10	N	10	N
18	7	.3	1,000	N	70	700	20	500	150	20	50	10	N
19	7	.5	1,000	N	N	300	15	50	50	N	50	15	150
21	5	.5	1,000	N	30	300	50	500	70	N	200	N	100
22	1.5	.07	700	N	20	500	L	L	7	N	30	15	300
23	10	.3	300	L	70	700	20	100	150	15	150	20	N
24	5	.3	G(5,000)	N	50	1,000	20	70	100	10	100	30	100
25	5	.3	500	N	150	500	20	100	100	L	70	20	N
36	7	.5	1,000	N	100	1,000	50	100	200	15	150	20	N
37	3	.2	3,000	N	70	1,000	70	50	150	N	150	20	N
38	10	.7	1,500	N	30	200	50	700	30	N	150	10	100
39	7	.5	1,000	N	15	200	50	500	100	N	150	15	1,000
40	7	.3	5,000	N	100	1,000	50	70	200	30	100	20	N
43	.5	.02	150	N	L	N	N	10	5	N	L	N	N
49	2	.2	1,500	N	50	300	20	30	30	N	50	10	N
57	2	.15	500	N	50	100	L	10	10	N	7	10	100
64	10	1	700	N	N	N	30	N	20	N	N	L	L
65	1	.03	150	N	N	N	N	N	7	N	N	L	L
66	10	.5	2,000	N	L	70	50	1,000	30	N	150	N	200
67	10	.5	700	N	N	20	10	300	50	N	30	L	100
68	10	.5	700	N	10	150	10	L	20	N	70	20	100
69	5	.3	200	N	100	700	L	200	70	5	20	10	N
70	.1	.01	150	10	30	200	N	N	15	20	N	100	N

Salmon-Trinity Alps Primitive Area, California—Continued

Sample	Semiquantitative spectrographic analyses—Continued (ppm)			Chemical analyses AA (ppm)			Inst (ppm)	Colorimetric (ppm)		Sample description[1]
	V (10)	Zn (200)	Zr (10)	Au (0.02)	Cu (10)	Zn (25)	Hg (0.01)	cxHM (0.5)	cxCu (1)	
AREA MM										
Stream sediments										
32	300	N	100	----------	40	20	------	3	N	----------
33	200	N	70	----------	40	30	------	2	N	----------
34	300	N	70	----------	60	95	------	5	3	----------
35	200	N	100	----------	40	40	------	3	N	----------
41	150	N	70	----------	40	35	------	2	2	----------
42	200	N	50	----------	80	120	------	9	N	----------
44	200	200	100	----------	120	100	------	20	3	----------
45	200	N	100	----------	35	35	------	1	N	----------
46	200	N	70	----------	95	110	------	9	3	----------
47	150	N	70	----------	75	95	------	9	4	----------
48	300	N	200	----------	35	30	------	2	N	----------
50	300	N	70	----------	35	30	------	1	L	----------
51	200	N	70	----------	40	30	------	3	N	----------
52	300	N	70	----------	35	30	------	1	N	----------
53	100	N	70	----------	30	80	------	5	N	----------
54	150	200	70	----------	55	200	------	35	N	----------
55	100	N	50	----------	40	120	------	11	N	----------
56	300	N	200	----------	40	30	------	1	N	----------
58	200	N	70	----------	40	30	------	1	N	----------
59	200	N	70	----------	40	40	------	3	N	----------
60	200	N	70	----------	70	110	------	9	N	----------
61	150	N	70	----------	45	40	------	2	4	----------
62	150	N	70	----------	60	170	------	9	N	----------
63	150	N	50	----------	50	130	------	45	N	----------
Rock samples										
1	50	N	70	0.55	----------		0.04	----------		FeOx st ch.
4	150	N	70	N(.05)	----------		.02	----------		Py siltstone.
5	150	N	150	N(.05)	----------		.02	----------		FeOx st ch-arg breccia.
6	300	N	20	N(.05)	----------		.04	----------		Fresh quartz diorite.
13	70	300	100	N(.05)	----------		.08	----------		FeOx st siltstone.
14	50	N	L	N(.05)	----------		.02	----------		Vein qtz in gs.
15	300	N	100	N(.05)	----------		.02	----------		Fresh gs.
16	15	N	L	N(.05)	----------		L	----------		4-in. qtz vein.
17	200	N	70	N(.05)	----------		.06	----------		FeOx st gossan float.
18	100	L	100	N(.05)	----------		.06	----------		FeOx st ch.
19	100	L	200	N(.05)	----------		.04	----------		FeOx st ch.
21	150	N	10	N(.05)	----------		.06	----------		Sheared metasiltstone.
22	10	N	50	N(.05)	----------		.04	----------		Altered 3 ft aplite dike.
23	150	500	150	N(.05)	----------		.70	----------		FeOx st ch.
24	150	200	150	N(.05)	----------		.55	----------		2 ft shear in chert.
25	150	300	100	L(.05)	----------		.16	----------		4 ft gouge in ch.
36	200	500	150	N(.05)	----------		.18	----------		4 ft shear in arg lower adit, SP.
37	100	500	100	N(.05)	----------		.24	----------		Shear at hw contact do.
38	150	N	150	.65	----------		.06	----------		Brown wx rk in fw upper pit, SP.
39	150	N	100	N(.05)	----------		.06	----------		Qtz with py.
40	150	300	100	L(0.05)	----------		.16	----------		Wet gouge in arg.
43	50	N	L	N(.05)	----------		.04	----------		Qtz vein in mv.
49	50	N	100	N(.05)	----------		.04	----------		FeOx st ch.
57	150	N	10	N(.05)	----------		.02	----------		Qtz vein in metasiltstone.
64	150	L	100	N(.05)	----------		.04	----------		FeOx st mv.
65	100	N	15	N(.05)	----------		L(.02)	----------		1- to 2-in. qtz vein.
66	200	200	50	N(.05)	----------		.04	----------		FeOx st ch.
67	200	N	50	N(.05)	----------		.02	----------		FeOx st metasiltstone.
68	70	700	500	N(.05)	----------		.02	----------		MnOx st metasiltstone.
69	150	N	100	N(.05)	----------		.12	----------		FeOx st arg and ch from dump.
70	70	N	L	.70	----------		.04	----------		Micaceous vein qtz from dump.

TABLE 1.—*Analyses of samples from the*

Sample	Semiquantitative spectrographic analyses												
	(percent)		(ppm)										
	Fe (0.05)	Ti (0.002)	Mn (10)	Ag (0.5)	B (10)	Ba (20)	Cu (5)	Cr (5)	Cu (5)	Mo (5)	Ni (5)	Pb (10)	Sr (100)
AREA NN													
Stream sediments													
1	7	1	1,500	N	30	200	50	1,500	50	N	200	N	200
3	7	1	1,500	N	30	20	50	300	70	N	70	N	150
4	7	.7	1,500	N	10	20	50	300	50	N	70	N	100
5	7	1	1,500	N	15	20	50	300	50	N	50	L	100
9	7	1	1,500	N	30	20	70	300	70	N	100	10	200
10	5	.7	700	N	10	N	30	200	50	N	50	N	150
11	7	1	2,000	N	20	L	50	300	70	N	70	N	100
12	5	.7	1,000	N	L	N	30	150	30	N	50	N	150
Rock samples													
2	3	0.2	300	N	N	L	20	200	20	N	50	L	N
6	.1	.01	70	N	10	N	N	20	L	N	L	10	N
7	.2	.03	50	N	L	N	N	10	10	N	L	N	N
8	20	.7	300	N	N	N	15	100	100	N	10	N	N
AREA OO													
Stream sediments													
1	5	0.5	1,000	N	30	300	30	300	50	N	150	10	L
2	5	.5	1,000	N	20	300	50	1,000	50	N	200	15	L
3	5	.5	1,000	N	20	300	50	1,000	50	N	300	15	L
4	5	.3	700	N	15	300	30	1,500	30	N	200	10	N

Abbreviations used in tables

alt = altered, alteration
amph = amphibolite
arg = argillite
ch = chert
FeOx = iron oxide
fw = footwall
gr = granitic, granite
gs = greenstone

AREA NN

Eight sediment samples and four rock samples were collected in area NN (fig. 3). Two samples (9 and 12) contain detectable zinc, and one (5) has a relatively high citrate-soluble heavy-metal (CxHM) content. In contrast with the adjoining area (P) to the north (Hotz and others, 1972), where there are several small mines and prospects, the samples from area NN are generally lower in Ba, Cu, Ni, and CxCu, and they contain no precious metals.

AREA OO

Four sediment samples were collected from St. Clair Creek (fig. 4). No rock samples were obtained. No unusual concentrations of metals in the drainage are indicated.

Salmon-Trinity Alps Primitive Area, California—Continued

Sample	Semiquantitative spectrographic analyses—Continued (ppm)			Chemical analyses AA (ppm)			Inst (ppm)	Colorimetric (ppm)		Sample description[1]
	V (10)	Zn (200)	Zr (10)	Au (0.02)	Cu (10)	Zn (25)	Hg (0.01)	cxHM (0.5)	cxCu (1)	
AREA NN										
Stream sediments										
1	300	N	200	----------	40	35	------	1	N(1)	----------
3	200	N	100	----------	45	50	------	4	N(1)	----------
4	200	N	70	----------	INS	INS	------	INS	INS	----------
5	200	N	100	----------	60	70	------	20	1	----------
9	300	300	100	----------	55	75	------	7	4	----------
10	200	N	70	----------	65	95	------	7	2	----------
11	300	200	100	----------	65	90	------	5	N(1)	----------
12	200	N	70	----------	70	95	------	3	2	
Rock samples										
2	70	N	L	N(.05)	----------		0.04	----------		Vein quartz in amph.
6	15	N	N	N(.05)	----------		L(.02)	----------		Vein quartz in amph.
7	15	N	N	N(.05)	----------		.04	----------		Vein quartz in amph.
8	30	N	100	N(.05)	----------		L(.02)	----------		FeOx st shear zone.
AREA OO										
Stream sediments										
1	150	L	100	----------	70	180	------	20	2	----------
2	150	L	100	----------	65	120	------	4	1	----------
3	150	L	100	----------	60	90	------	2	1	----------
4	150	N	70	----------	55	110	------	4	L(1)	----------

hw = hanging wall
mv = metavolcanic
py = pyritic, pyrite
qtz = quartz
rk = rock
st = stain(ed)
SP = Shoestring prospect
wx = weathered

MINERAL COMMODITIES

Gold is the only resource of potential importance in the areas examined during this supplementary study. A few rock samples contain traces of gold. Small prospects for gold occur in some of the areas examined, but the only production has been from small placer deposits along the North Fork Trinity River.

Anomalous amounts of copper and zinc occur in scattered samples from some of the areas investigated, but no concentrations of economic importance were found.

Sediment samples, especially from area MM, commonly contain higher than background amounts of chromium and nickel. However, such samples are not indicative of economic deposits. Typically, these elements are relatively abundant in mafic and ultramafic rocks, which are common in the areas under investigation.

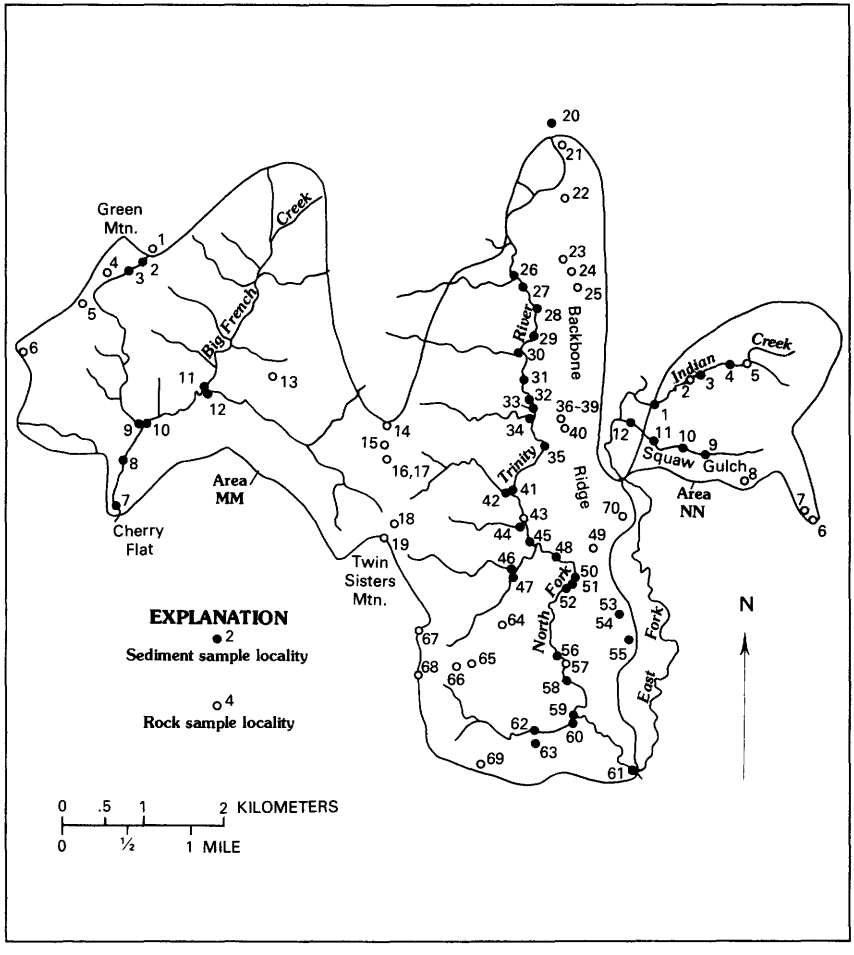

FIGURE 3.—Sample locations in areas MM and NN.

OTHER COMMODITIES

Limestone (marble) occurs in small lenses throughout the area, and a large deposit occurs on Limestone Ridge on the east edge of area OO. Limestone Ridge is in such rugged terrain and is so far from transportation facilities and potential markets, however, that it is not likely to be of economic importance. The study areas have no potential for combustible fuels, and the absence of hot springs or other surface manifestations of high heat flow and the absence of late Tertiary or Quaternary volcanic rocks indicate that the areas have no significant potential for geothermal energy.

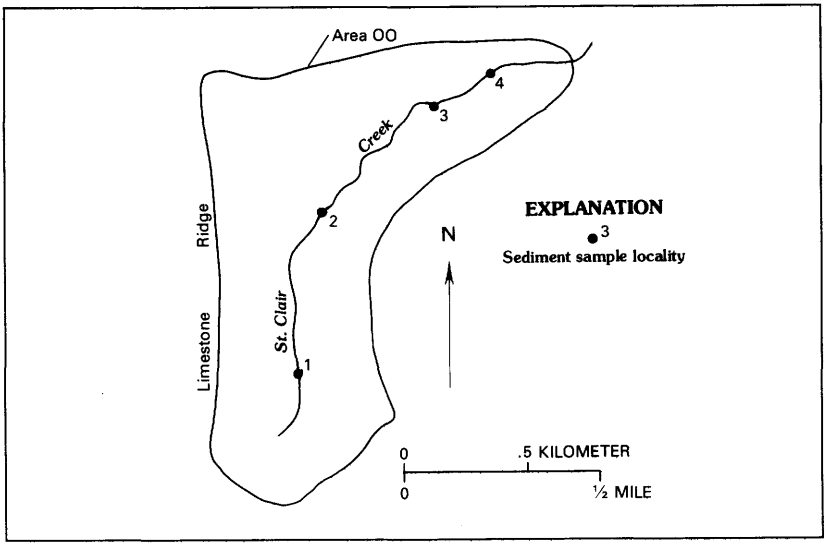

FIGURE 4.—Sample locations in area OO.

AEROMAGNETIC SURVEY

An aeromagnetic survey of the Salmon-Trinity Alps Primitive Area was flown by the U.S. Geological Survey in 1970. The data are presented as magnetic contours on plate 1. Only two of the proposed additions, area LL and area OO (fig. 1; pl. 1), were included in the original aeromagnetic survey. The southern additions, areas MM and NN, were not included because the original survey ended at the south boundary of the original primitive area.

Andrew Griscom, interpreting the magnetic data in U.S. Geological Survey Bulletin 1371–B (Hotz and others, 1972), noted that a strong linear magnetic high is associated with a large, northwest-trending granitic pluton. He stated (Hotz and others, 1972, p. B46) that a "linear magnetic low paralleling this magnetic high on its east side is a polarization low caused by the inclination of the earth's field and is a normal feature associated with the northeast side of steeply dipping magnetic rock masses in the Western United States."

A magnetic high on the east border of this area about 1.5 mi (2.4 km) southwest of Salmon Mountain is situated over a topographic high where two small bodies of serpentinite and a small subcircular granitic body crop out.

ECONOMIC APPRAISAL

By TERRY J. CLOSE and ROBERT K. EVANS

The only metal of significance found in the study areas is gold. Limestone occurs as isolated bodies in remote parts of the study areas. It is far from potential markets, and transportation cost probably would exceed its value. Chromite bodies are reported to occur in ultramafic rocks in area MM, but none was observed. Those examined in other parts of the Salmon-Trinity study area contained only a few hundred tons each and were sparsely distributed (Hotz and others, 1972). Deposits of sand and gravel are plentiful in areas NN, MM, E, and LL, but they are too far from market to be economically minable.

Instabilities in the international monetary system, as well as steadily increasing industrial consumption, indicate that demand for gold will exceed supply for an indefinite period. The United States, in 1972, produced 1.45 million oz (45.1 million g), while consuming 7.5 million oz (233 million g) (U.S. Bureau of Mines, 1973). Since 1968, the free-world market price has been in a rising trend that began at $35 per troy oz ($1.13/g), and has gone higher than $150 ($4.88/g). In this report, the value of gold in placer resources is based on a price of $150 per troy oz (Engineering and Mining Journal, 1974).

Gold was found in nearly all 105 placer samples taken in the study areas. Ninety-five percent of the gold in the placer samples was semiangular to well-rounded coarse gold that could be picked out with the fingers. Gold fineness ranges from 838 to 918 parts gold per thousand and averages 879. The gold in placer deposits was weathered from quartz veins not far upstream from the study areas. Some placer gold found along the lower North Fork of the Trinity River in area MM came from residual deposits in red soil zones which have formed over the ultrabasic intrusive and metavolcanic country rock.

The placer samples contain up to 37.9 lb (17 kg), averaging 4.3 lb (1.9 kg), of black sand per cubic yard of gravel. The magnetite content of the black sand was as much as 11.8 lb (5.3 kg), averaging 0.6 lb (0.3 kg) per cubic yard. No minerals of economic importance other than gold and the associated silver occur in the black sand.

PLACER MINING COSTS

Gold in the stream-channel deposits in the study areas was largely unrecoverable because of the fast water until the recent development of small portable suction dredges. Since the appearance of these dredges, numerous attempts have been made to mine these gravels. Not many such attempts have been profitable, however, because a small dredge is capable of mining less that 8 cubic yards (6 m^3) per

hour, one or more divers is required to operate a dredge, a large amount of gasoline is consumed, and, most importantly, gold values are erratically distributed in pockets. The gold is concentrated in pockets on bedrock or in crevices 2 to 3 feet (0.6–0.9 m) below the average bedrock surface. Usually 1 to 4 feet (0.3–1.3 m) of barren gravel overburden must be dredged before gold is exposed.

Even with an experienced miner and sufficient prospecting to delineate most favorable pockets, stream-channel gravel would probably have to average more than 85 cents in gold per cubic yard ($1.11/m^3) to be economically minable. Commonly, however, coarse gold sells at premium prices for use as specimen and jewelry.

Of the small bench deposits in the study areas, 60 to 80 percent have been mined. The gravel that remains was not mined because the gold values are erratically distributed, water could not be brought to the gravel, or the gravel was too low grade. Bench deposits were minable in the past because hand labor was cheap. The current high cost of labor makes the use of machinery necessary. Deposits in the study areas, however, are too small to justify the expenditure of capital required to obtain large equipment, such as a dragline dredge or mobile wash plant.

The cheapest way to mine the bench gravel in the study areas is to bulldoze the gravel into a sluice box. Water for washing the gravel in most instances would have to be pumped to the sluice box. Gravel would have to average over 55 cents in gold per cubic yard (72 cents/m^3) to be economically minable.

LODE MINING COSTS

The cost of mining and milling of small underground lode deposits would be about $35 per ton ($39 per tonne) for veins 5 ft (1.5 m) thick and $55 per ton ($61 per tonne) for veins 1 ft (0.3 m) thick. Gold ore would have to average 0.23 oz to 0.37 oz gold per ton (7.8–12.6 g per tonne) at the February 1974 price to be economically minable. Only one sample from study area lode deposits contained as much as 0.23 troy oz gold per ton (7.8 g per tonne).

Significant quantities of silver occur only in the lode deposits; there is no indication that any deposit could be mined for silver alone. However, byproduct silver could be recovered from lode gold ore. Average price of silver was $5.36 per troy oz (17 cents per g) in February 1974 (Engineering and Mining Journal, March 1974).

MINING CLAIMS

At least 228 mining claims, of which 117 are placer claims and 111 are lode claims, have been located within the study areas since the 1980's. None of the mining claims in the study areas are patented.

Area NN, which is part of the East Fork mining district, has had 49 placer and 90 lode claims located within its boundaries. Area MM, which is part of the North Fork mining district, has had 35 placer and 11 lode claims. Area E, part of the New River mining district, had had 33 placer mining claims located within its boundaries. Area LL, part

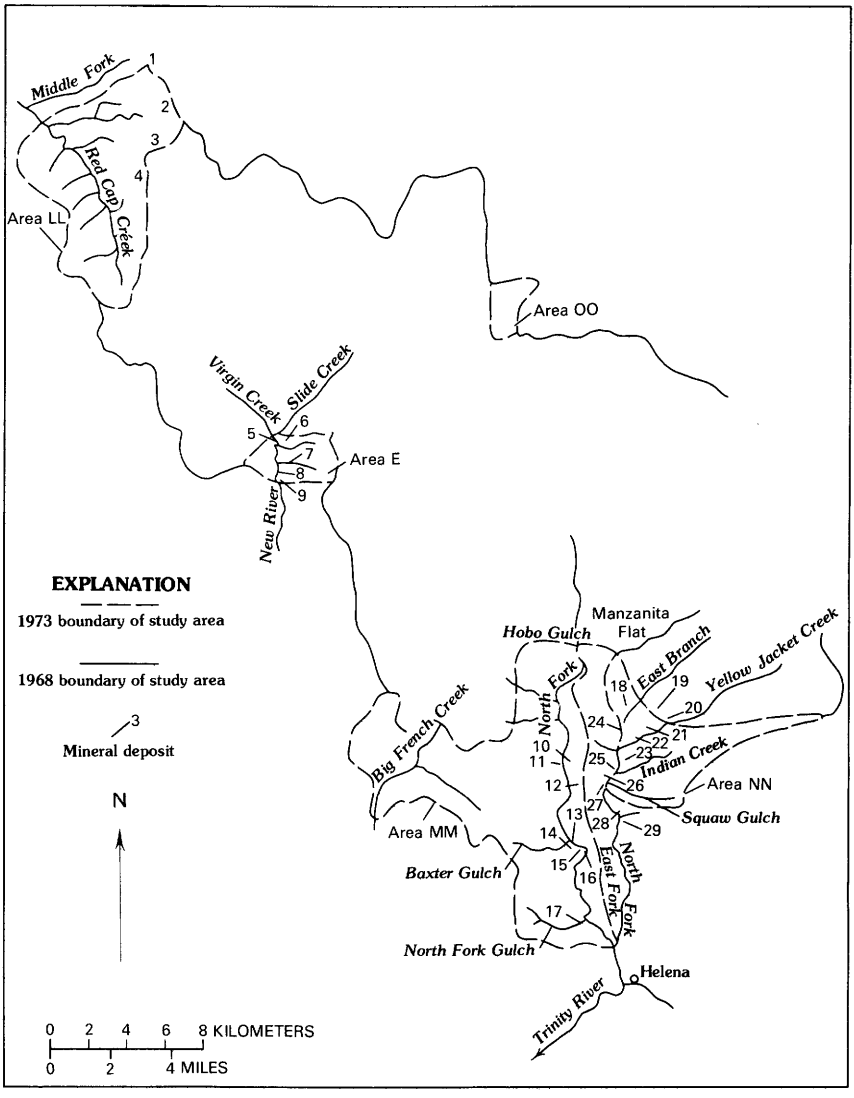

FIGURE 5.—Mineral deposits in 1973 proposed additions to Salmon-Trinity Alps Primitive Area.

of the Red Cap mining district, has had a total of 10 lode mining claims. No mining claims have been located within area OO.

MINES AND PROSPECTS

AREA NN

Area NN was mapped by the U.S. Geological Survey (Hotz and others, 1972) during the study of the Salmon-Trinity Alps Primitive Area but was not studied by the Bureau of Mines at that time.

Gold-bearing placer gravel is the principal mineral resource of area NN (fig. 5, table 2), and about 80 percent of the bench gravel and some of the stream gravel deposits have been mined.

The portion of the East Fork of the North Fork Trinity River within area NN is 27,000 ft (8,200 m) long. It enters area NN at an elevation of about 2,950 ft (900 m), exits at an elevation of about 2,000 ft (610 m), and has a gradient of about 185 ft per mile (35 m per km). The portion of the East Branch within area NN is about 6,000 ft (1,800 m) long. It has a gradient of about 110 ft per mile (20 m per km). The portion of Yellow Jacket Creek within area NN is about 9,000 ft (2,700 m) long. It has a gradient of about 450 ft per mile (85 m per km).

TABLE 2.—*Principal placer deposits in area NN*

Name of deposit	Extent (acres)	Volume (cu yd)	Range of gold values (cents per cu yd)[1]	Number of samples	Average gold content in samples (cents per cu yd)[2]
East Branch stream deposits[3]	7	34,000	38.9	1	38.9
Bolt placer, bench deposits	.9	36,000	3.2 - 235.2	8	76.8
Unique placer, bench deposits	6.2	136,000	<.3 - 34060.5	20	144.3
Yellow Jacket Creek bench deposits	5	10,000	<.3 - 154.4	2	109.4
Yellow Jacket Creek stream deposits[3]	10	48,000	<.3 - 2235.3	9	532.6
Two Hits and A Miss placer, bench deposits	1.8	26,000	3.6	1	3.6
Ida placer, bench deposits	1.6	26,000	<.3 - 353	4	182.4
East Fork stream deposits[3]	33	160,000	19.2 - 600.8	5	302.2
Total	65.5	476,000	---	---	---

[1]The cents per cubic yard is based on a gold price of $150 per troy ounce. One cent per cubic yard equals 0.0027 gram per cubic meter.

[2]Weighted by sample length.

[3]Includes all stream gravel along streams in study area, claimed or unclaimed.

Mineral deposits in the 1973 proposed additions to the Salmon-Trinity Alps Primitive Area

Map Ref. No.	Name of Property
1	Kublia gold prospect
2	Salmon Mountain prospect
3	Red Cap Lake prospect
4	Devils Backbone prospect
5	Virgin Creek placer
6	Shield placer
7	Dot placer
8	State placer
9	Barron Creek placer
10	Dan Raymond placer
11	Raymond Gulch placer
12	Busted Shoestring lode
13	Waldorff Crossing placer
14	Baxter Gulch placer
15	Lotus No. 1 placer
16	Lotus No. 2 placer
17	North Fork Gulch placers
18	Bolt placer
19	North Black Gulch prospect
20	South Black Gulch prospect
21	Yellow Jacket Ridge prospect
22	Yellow Jacket Creek placers
23	Two Hits And A Miss placer
24	Unique placer group
25	Indian Creek bench
26	North Squaw Gulch bench
27	South Squaw Gulch bench
28	Ida placer Yellowstone mine
29	Enterprise-Lone Jack mine

The streams in area NN are rejuvenated and have cut deeply into bedrock. In places, the bench placers are 50 ft (15 m) above present stream level. Bedrock is the Salmon Hornblende Schist, which is altered, intensely fractured, and cut by numerous quartz veins and mafic dikes. The fractures, and other irregularities provided by differentially eroded dike contacts, provide good gold traps, but make recovery of gold difficult. Modern mining practice is to mine gold-bearing gravel from fractures and from behind dikes with small suction dredges. During spring runoff, some crevices previously covered by deep gravel commonly are uncovered and other crevices previously mined are filled with gold-bearing gravel. However, the gold in crevices is the result of hundreds of seasons of accumulation.

The placer mining claims currently being held in area NN are the Unique, Bolt, Ida, and Two Hits And A Miss. All but the upper Bolt

claim are accessible by road. The bench placers contain about 198,000 cubic yards (151,390 m^3) of minable or paramarginal resources that may average 144 cents in gold per cubic yard[1] (0.54 g/m^3). Stream deposits are currently being mined only at the Bolt and Unique claims. Stream channel deposits on these claims total 74,000 cubic yards (56,580 m^3) of gravel. Samples taken on bedrock averaged 182 cents in gold per cubic yard, but the overlying gravel is relatively low grade. About 15 percent of the channel gravel is estimated to be minable at a gold price of $150 per troy oz.

Sporadic exploration and development work has been done on lodes in and adjacent to area NN since the 1890's, and most of it was concentrated on Yellow Jacket Ridge. The lodes consist of groups of discontinuous quartz veins cutting the metamorphic country rock. Most veins are less than 0.5 ft (0.2 m) thick, and some are as much as 2 ft (0.6 m) thick. They are composed of vuggy white quartz and in places contain up to 5 percent hematite-limonite pseudomorphs after pyrite and galena. The veins are oxidized at the surface and in some places contain free gold. No lode production has been recorded from area NN, but over $500,000 in gold, silver, copper, and lead has been produced from the Yellowstone and Enterprise-Lone Jack mines just to the south. Lode resources at two properties on Yellow Jacket Ridge total 5,000 tons (4,500 tonnes) of ore that might average 0.12 oz gold and 0.25 oz silver per ton (4.1 and 8.6 g per tonne) and a trace of lead. The deposits are too remote and small to be economically minable; however, the gold values indicate that exploration might disclose economically minable deposits.

PLACERS

THE UNIQUE PLACER GROUP

The Unique placer (fig. 5, No. 24) is in the East Fork of the North Fork of the Trinity River and extends from Yellow Jacket Creek upstream to the East Branch (fig. 6). The placer consists of six bench deposits and over 1 mile (1.6 km) of stream channel deposits.

The bench deposits are on metamorphic bedrock 10 to 50 ft (3–15 m) above the present stream level. The gravel is 5 to 50 ft (1.5–15 m) thick, clean and well rounded, and contains boulders up to 10 ft (3 m) in diameter. Gold is concentrated on or within 2 ft (0.6 m) of bedrock.

The Unique benches contain about 136,000 cubic yards (104,000 m^3) of gravel (table 3). Samples, weighted by length, averaged 144

[1]Cents per cubic yard is based on samples, weighted by length, unless otherwise noted. Paramarginal means the resource borders on being economically minable. Submarginal indicates that the resource would require a substantially higher price (more than 1.5 times of determination) to be economically minable. All figures are based on costs in 1974.

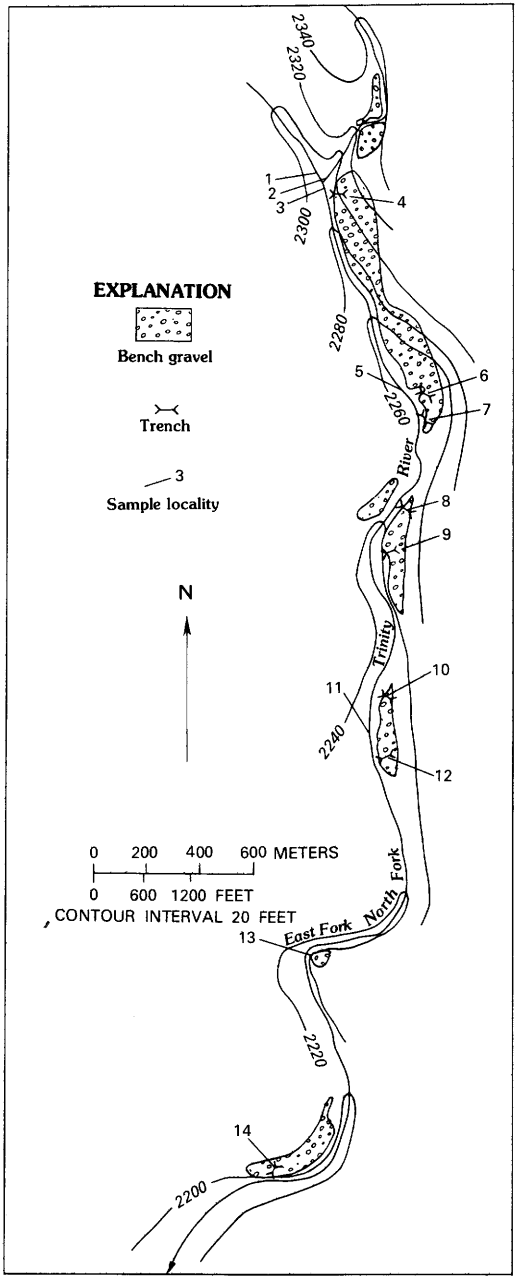

FIGURE 6.—Unique placer.

Data for samples from localities shown in figure 6

Locality	Depth Interval (feet)	Sample volume (cu ft)	Gold content (cents per cu yd)[1]	Black sand (pounds per cu yd)	Remarks
1	0 - 0.5	0.4	239.0	14.9	Select sample of stream gravel
2	0 - .5	.9	43.3	7.8	Select sample of stream gravel
3	0 - .5	.4	488.7	6.6	Select sample of stream gravel
4	0 - 6	2.5	<.3	Trace	Bench gravel and bedrock
5	0 - .5	.2	19.2	6.2	Select sample of stream gravel
6	0 - 7	4.0	16.3	1.5	Bench gravel and bedrock
	7 - 8.5	1.5	<.3	2.2	Bedrock
7	0 -17.5	17.5	2.3	.3	Bench gravel
	17.5-18.5	1.6	15	2	Bench gravel and bedrock
8	0 - 7.5	7.5	2.5	.3	Bench gravel
	7.5-12.5	5.0	1.5	.6	Bench gravel
	12.5-13.5	1.0	12.1	2.8	Bench gravel and bedrock
9	0 -12	8.0	2.6	2.4	Bench gravel
	12 -14.5	2.5	<.3	1.1	Bench gravel and bedrock
10	0 - 5.5	5.5	9.6	.5	Bench gravel
	5.5- 9.5	4.0	<.3	.7	Bench gravel
	9.5-10.1	1.0	<.3	3	Bench gravel and bedrock
11	0 - .5	.6	462.2	2.3	Select sample of stream gravel
12	0 - 6	6	<.3	.5	Bench gravel
	6 - 7	2	1.3	1.2	Bench gravel and bedrock
13	0 - .5	1.5	768	2.6	Bench gravel and bedrock
14	0 - .8	.8	<.3	3.1	Bench gravel
	.8- 3.8	3.0	63.4	1	Bench gravel
	3.8- 7.3	3.5	<.3	1.7	Bench gravel
	7.3- 8.3	4.0	34,060.5	2.3	Bench gravel and bedrock

[1]Calculated using a gold price of $150 per troy oz. One cent per cubic yard equals 0.0027 gram per cubic meter.

TABLE 3.—*Summary of data for Unique bench deposits*

Bench	Extent (acres)	Volume (cu yd)	Average gold content in samples (cents per cu yd)[1]
A	0.7	8,700	<0.3
B	3.2	62,000	6.6
C	.5	9,000	2.5
D	.5	7,900	3.2
E	.1	1,400	767.3
F	1.2	47,000	4126.9
Total-------	6.2	136,000	---

[1]The cents per cubic yard is based on a gold price of $150 per troy oz and samples weighted by length. One cent per cubic yard equals 0.0027 gram per cubic meter.

cents per cubic yard (0.4 g/m^3). The average, exclusive of those on bedrock, was only 5 cents per cubic yard (0.01 g/m^3). The benches appear to be a submarginal resource but may be paramarginal because of the high-grade pockets of gold near bedrock.

The stream channel on the Unique claim contains about 40,000 cubic yards (31,000 m^3) of gravel. Although samples taken near bedrock averaged 301 cents in gold per cubic yard, the overlying gravel is relatively low grade. About 15 percent of the channel gravel may be minable at a gold price of $150 per troy oz.

BOLT PLACER

The Bolt placer (fig. 5, No. 18) consists of two placer claims on deposits that extend from a quarter of a mile (0.4 km) to approximately 2 miles (3.2 km) above the mouth of the East Branch. The deposit includes two small, tree- and brush-covered, partly mined gravel benches and about 2 miles (3.2 km) of stream channel gravel.

The claim owner, Elmer Bolt, has attempted to mine the upper bench but has concentrated his efforts on the stream-channel deposits from which he recovered about a quarter of an ounce (8 g) of gold in two days during 1973. His mining equipment consisted of a diver's face mask and some small hand tools. The stream-channel deposits of the Bolt placer contain about 34,000 cubic yards (26,000 m^3) of gravel.

The two benches consist of 1–10 ft (0.3–3 m) of gravel lying on metamorphic bedrock 5–20 ft (1.5–6.0 m) above the present stream level. The gravel is well rounded and contains boulders up to 4 ft (1.2 m) in diameter. The gold is coarse and semiangular, and it is concentrated on or near bedrock.

The lower bench (fig. 7) contains a paramarginal resource of about 10,000 cubic yards (8,000 m^3) of gravel estimated to average 149 cents gold per cubic yard.

The upper bench contains a paramarginal resource of about 26,000 cubic yards (20,000 m^3) of gravel. Samples taken at three sites on the bench contained from 3.2 to 137 cents and averaged 50 cents in gold per cubic yard.

Data for samples from localities shown in figure 7

Locality	Depth Interval (feet)	Sample volume (cu ft)	Gold content (cents per cu yd)[1]	Black sand (pounds per cu yd)	Remarks
1	0 - 3	3.0	121.7	1.9	Bench gravel
	3 - 4	1.0	235.2	4	Bench gravel and bedrock

[1]Calculated using a gold price of $150 per troy oz. One cent per cubic yard equals 0.0027 gram per cubic meter.

IDA PLACER

The Ida placer (fig. 5, No. 28), located on the same patented Ida lode claim as the Yellowstone mine, is at the end of the East Fork road just south of the study area. The placer is a partly mined, tree- and brush-covered bench deposit (fig. 8). The gravel that remains is adjacent to talus-covered slopes. It is 20 ft (6 m) thick on the upstream end

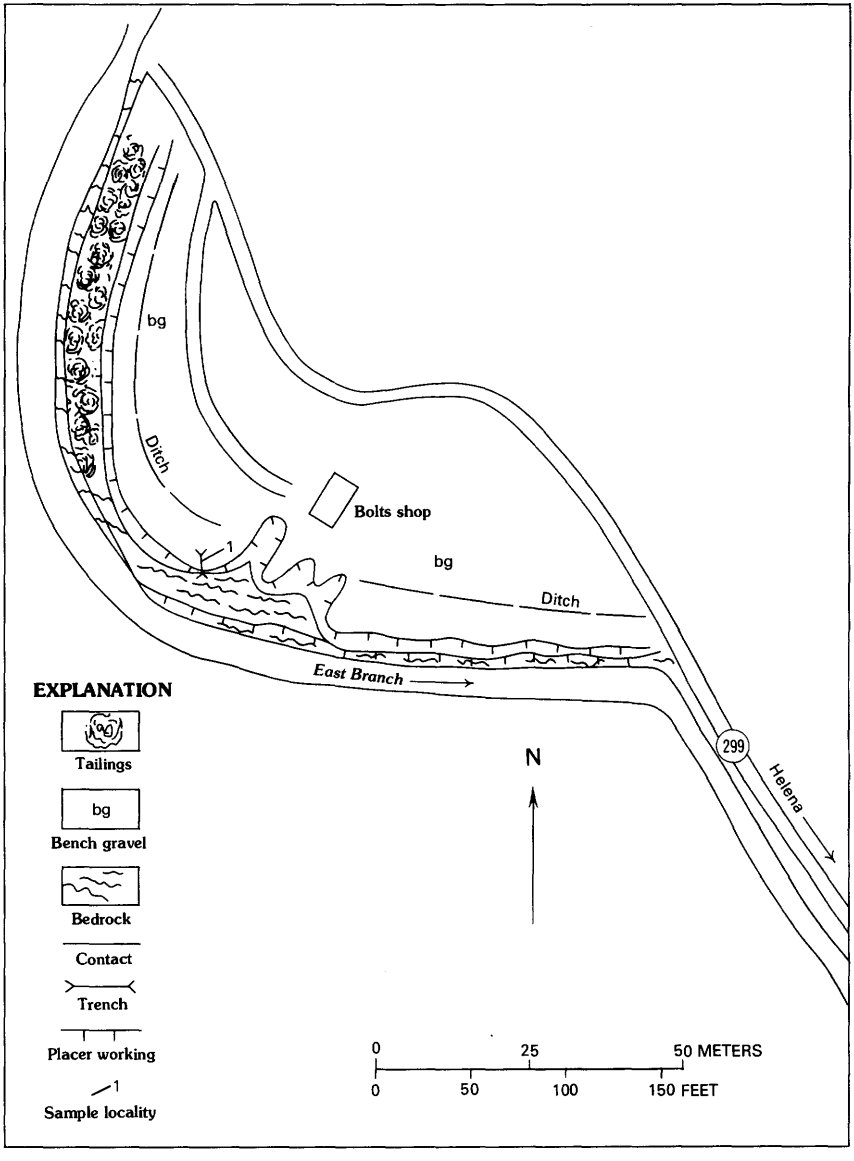

FIGURE 7.—Lower bench, Bolt placer.

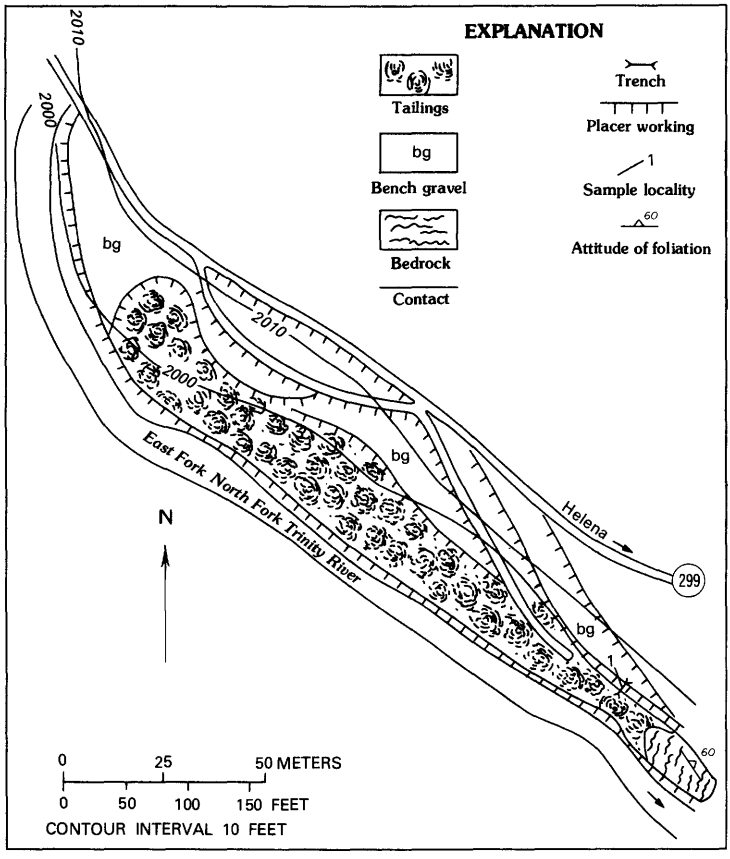

FIGURE 8.—Ida placer.

Data for samples from localities shown in figure 8

Locality	Depth Interval (feet)	Sample volume (cu ft)	Gold content (cents per cu yd)[1]	Black sand (pounds per cu yd)	Remarks
1	0 - 3	3	0.3	0.4	Bench gravel
	3 - 6	3	1.7	.7	Bench gravel
	6 - 7.5	2.5	55.4	3.4	Bench gravel
	7.5-15	4.5	352.7	7	Bench gravel and bedrock

[1]Calculated using a gold price of $150 per troy oz. One cent per cubic yard equals 0.0027 gram per cubic meter.

and thins to less than 2 ft (0.6 m) on the downstream end of the bench. The gravel, which is well rounded, is overlain by up to 6 ft (1.8 m) of soil and angular talus; it rests on metamorphic bedrock that locally is as much as 30 ft (9 m) above the present stream level.

About 26,000 cubic yards (20,000 m^3) of gravel is estimated to occur in the Ida placer deposit. Weighted average gold content in four samples was 182 cents per cubic yard. The samples indicate the deposit may be economically minable.

TWO HITS AND A MISS PLACER

The Two Hits And A Miss placer (fig. 5, No. 23) is on the East Fork of the North Fork of the Trinity River about half a mile (0.8 km) upstream from Indian Creek.

The placer is a partly mined bench deposit on metamorphic bedrock 20–40 ft (6–12 m) above present stream level (fig. 9). The deposit is

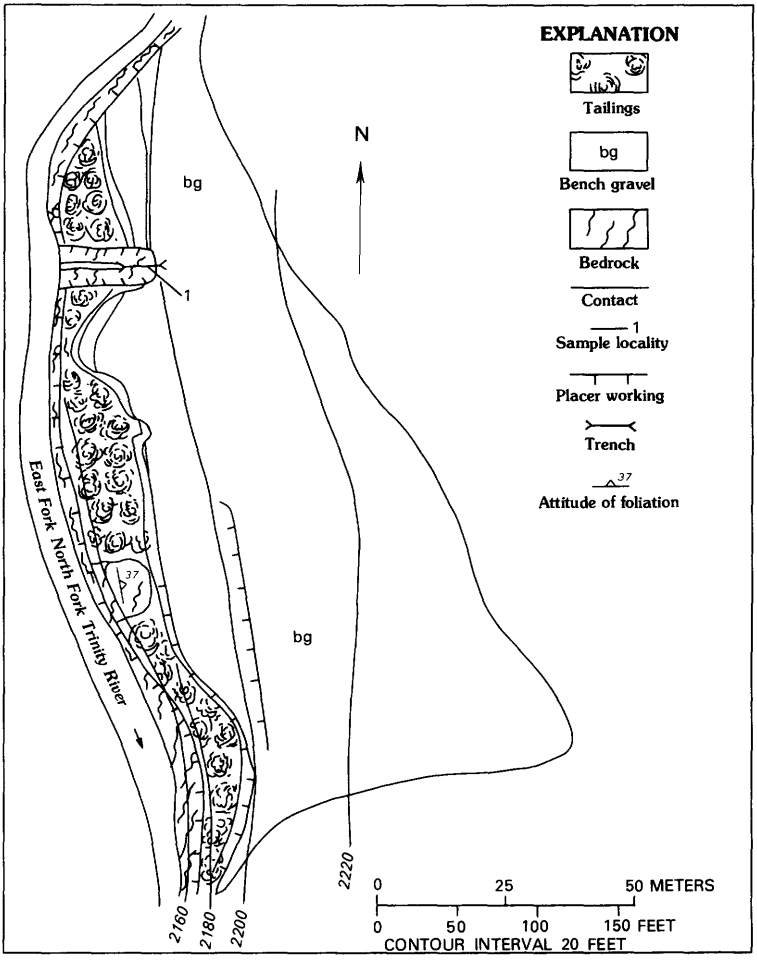

FIGURE 9.—Two Hits And A Miss placer.

covered by less than a foot of fine talus; it is 5–20 ft (1.5–6 m) thick and consists of clayey, iron oxide-stained, well-rounded gravel containing boulders up to 10 ft (3 m) in diameter. The gravel consists of metamorphic rock with minor amounts of granitic and dioritic rock. Gold is concentrated on bedrock although some is on or in clay lenses.

The Two Hits And A Miss deposit contains about 26,000 cubic yards (20,000 m^3) of gravel. An 81-cubic-foot (2.3 m^3) sample taken to a depth of 20 ft (6.0 m) contained 2.5 cents gold per cubic yard and 0.1 lb of black sand per cubic yard (0.06 kg/m^3). The owners reported that 5 cubic yards (6.5 m^3) containing 1 oz (31 g) of coarse, well-rounded gold ($20.68 per cubic yard) was mined from the same site by hydraulic methods in 1972.

YELLOW JACKET CREEK PLACERS

A few remnant bench deposits along Yellow Jacket Creek (fig. 5, No. 22) are estimated to contain about 10,000 cubic yards (8,000 m^3) of gravel. Two samples (fig. 10) taken on bedrock averaged 75 cents gold per cubic yard, but these deposits are probably submarginal because the average gold content would be much less. The bench gravel is on metamorphic bedrock 10–20 ft (3–6 m) above present stream level. It is as much as 40 ft thick, consisting of well-rounded

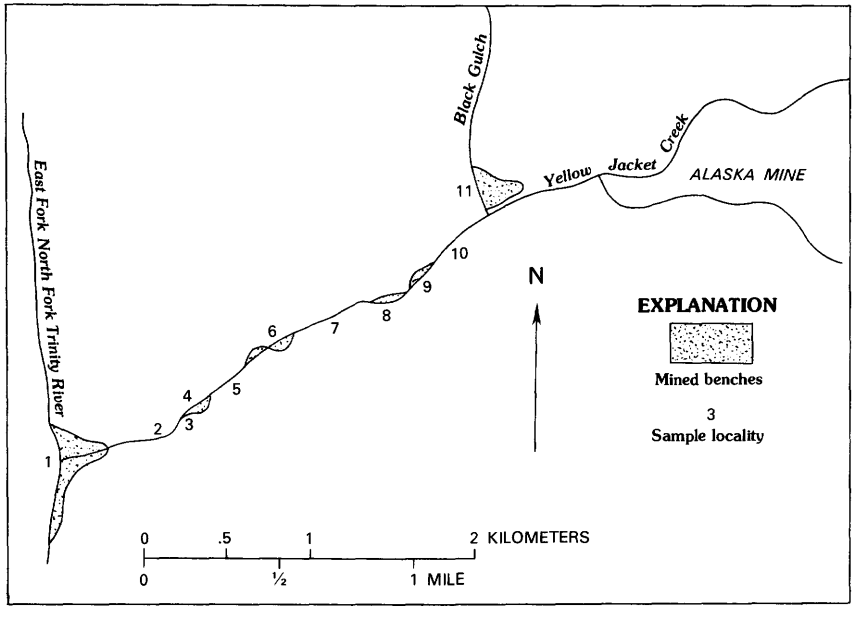

FIGURE 10.—Yellow Jacket Creek placers.

Data for samples from localities shown in figure 10

Locality	Depth Interval (feet)	Sample volume (cu ft)	Gold content (cents per cu yd)[1]	Black sand (pounds per cu yd)	Remarks
1	0 - 0.5	0.8	496.2	5.3	Select stream gravel sample from Yellow Jacket Creek
2	0 - .5	.8	587.9	4.8	Do.
3	0 - .5	.7	666.2	5.6	Do.
4	0 - .5	.4	315.1	9.3	Select sample of stream gravel
5	0 - .5	.5	220.1	6.2	Bench gravel from bedrock
6	0 - .5	.3	43.3	8.9	Select sample of stream gravel
7	0 - .5	.6	2235.3	7.0	Do.
8	0 - .5	1.1	307.9	4.7	Do.
	0 - .5	.4	.3	3.0	Bench gravel from bedrock
9	0 - .5	.4	651.6	4.4	Select sample of stream gravel
10	0 - .5	.3	.3	4.3	Do.
11	0 - .5	.4	22.6	2.9	Do.

[1]Calculated using a gold price of $150 per troy oz. One cent per cubic yard equals 0.0027 gram per cubic meter.

pebbles, cobbles, and boulders, some of which are 10 ft (3 m) in diameter.

The stream channel along Yellow Jacket Creek contains about 48,000 cubic yards (37,000 m^3) of gravel. Samples taken on bedrock averaged 533 cents in gold per cubic yard, but all of the gravel averages 87 cents per cubic yard. Small-scale mining might be successful.

DENUDED BENCHES

A number of bench deposits in area NN, including benches near Squaw Gulch, Indian Creek, and along Yellow Jacket Creek, have been completely mined. The denuded benches are 10–30 ft (3–9 m) above present stream level. In an attempt to determine how much gold remains on the bedrock after mining, areas measuring 1 square yard (0.8 m^2) on south Squaw Gulch, north Squaw Gulch bench, and Indian Creek bench were sampled (fig. 5, Nos. 25, 26, and 27). The samples contained 4.4 cents or less in gold.

A select sample of stream-channel gravel from Squaw Gulch contained less than 0.3 cent in gold per cubic yard of gravel. A select sample of stream channel gravel from Indian Creek contained 39.4 cents in gold per cubic yard of gravel.

LODES

YELLOW JACKET RIDGE PROSPECT

The Yellow Jacket Ridge prospect (fig. 5, No. 21) consists of two caved adits and two small exploration pits (fig. 11). The workings are along a quartz vein striking N. 80° W. and dipping 80° to 85° NE in metamorphic rocks near or along their contacts with a dioritic intrusion. The vein is composed of vuggy white quartz and less than 5 percent pyrite and limonite-hematite pseudomorphs after pyrite. It is 2 ft (0.6 m) wide and is exposed intermittently over a length of 150 ft (45 m). Beyond the workings, the vein is concealed.

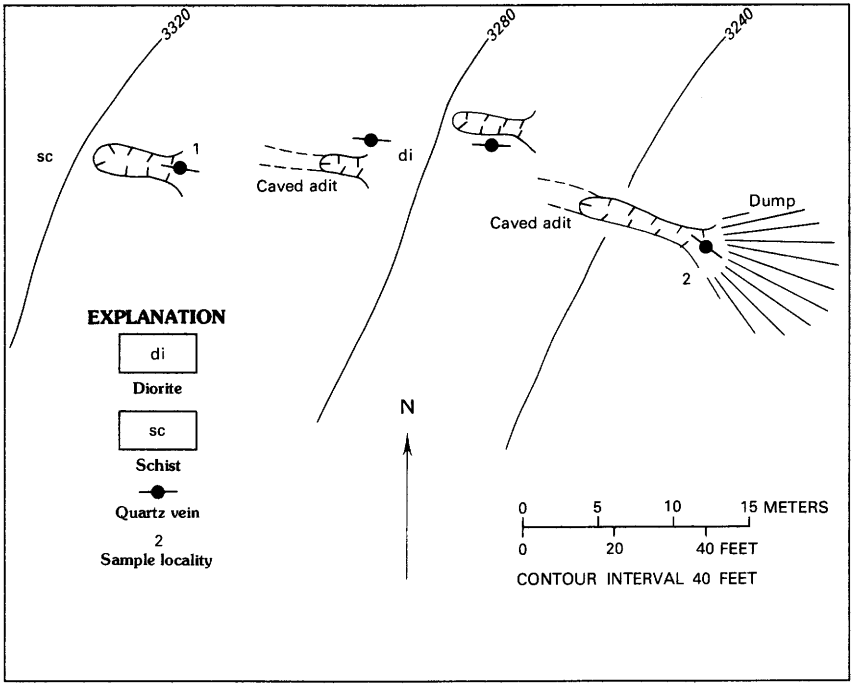

FIGURE 11.—Yellow Jacket Ridge prospect.

Data for samples from localities shown in figure 11

[N, none detected]

No.	Type	Sample Length (feet)	Description	Gold (ounce per ton)[1]	Silver (ounce per ton)[1]	Lead (percent)
1	Grab	0	Quartz	0.34	0.4	0.01
2	Chip	2	Across vein	.09	.2	N

[1]One oz per ton equals 34.3 grams per tonne.

The Yellow Jacket Ridge deposit contains an indicated submarginal resource of about 2,500 tons (2,300 tonnes) of ore averaging about 0.2 oz gold and 0.3 oz silver per ton (7 g and 10 g per tonne) and 0.01 percent lead.

NORTH BLACK GULCH PROSPECT

The North Black Gulch prospect (fig. 5, No. 19) consists of a caved adit and three small exploration pits. The workings are along a vertical quartz vein striking N. 40° W. that cuts metasedimentary rocks along or near a dioritic intrusion. The vein is composed of massive, vuggy, white quartz containing 5 percent limonite-hematite pseudomorphs after pyrite and less than 1 percent pyrite. The vein is 1.5 (0.5 m) wide and is exposed over a length of 200 ft (60 m) by the workings. Beyond the workings the vein is concealed by as much as 8 ft (2.4 m) of overburden.

The North Black Gulch prospect has about 2,500 tons (2,300 tonnes) of submarginal reserves containing 0.03 oz gold and 0.2 oz silver per ton (1 g and 7 g per tonne).

SOUTH BLACK GULCH PROSPECT

The South Black Gulch prospect (fig. 5, No. 20) consists of a caved shaft, an adit, several small exploration pits, and a millsite. Deep overburden and dense brush cover the area, and no mineralized rock is exposed. Material on the mine dumps indicates that the workings are on a 2-ft-wide (0.6 m) quartz vein cutting metasedimentary country rock. The vein material consists of massive vuggy white quartz and less than 5 percent pyrite, limonite-hematite pseudomorphs after pyrite, and galena. Samples contained traces of gold, as much as 0.01 oz silver per ton (0.3 g per tonne), and 0.02 percent lead.

LODE MINES ADJACENT TO AREA NN

The Yellowstone and Enterprise-Lone Jack lode mines are half a mile (0.8 km) outside the southern boundary of area NN. The Enterprise-Lone Jack mine explores quartz vein structures that may extend into the study area.

The Yellowstone and the Enterprise-Lone Jack mines were intermittently productive from 1889 until 1941, yielding 25,500 oz (793,000 g) gold, 3,700 oz (115,000 g) silver, 50 lb (23 kg) copper, and 500 lb (230 kg) lead, all valued at over $500,000. Except for occasional exploration work, the mines have been idle since World War II. Because of the low grade of remaining resources and increasing costs, the mines were not reopened after World War II.

Yellowstone Mine

The Yellowstone mine (fig. 5, No. 28) is developed by 2,300 ft (700 m) of underground workings, which are now inaccessible. They are on a 3-ft-wide (0.9 m) quartz vein that strikes N. 58° W., and dips 31° NE. along the contact of a diorite intrusive and metamorphic country rock (O'Brien, 1965). The vein consists of white quartz and partially oxidized metallic sulfides. Gold-bearing oxidized sulfides occur along the veins in shoots up to 70 ft (20 m) long.

Enterprise-Lone Jack Mine

The Enterprise-Lone Jack mine (fig. 5, No. 29) is on a series of parallel veins and crosscutting stringers that trend northeast and dip 10° to 20° SE. in metamorphic rocks. The veins and stringers consist of 2–6 ft (0.6–1.8 m) of quartz containing free gold in association with 5–10 percent pyrite, galena, and sphalerite, and were stoped for 1,600 ft (490 m) along the dip. They appear to continue to the northeast and may extend into area NN.

Samples of vein material from the Enterprise workings contain from nil to 1.23 oz gold per ton (42.2 g per tonne), nil to 5 oz silver per ton (170 g per tonne), 0.2 percent lead, and a trace of copper. Samples of vein material from the Lone Jack contain from a trace to 0.81 oz gold per ton (28 g per tonne), 0.1 to 1.2 oz silver per ton (3–41 g per tonne), 0.2 percent lead, and a trace of copper.

AREA MM

The mineral resources of area MM consist of gold-bearing bench and stream-channel placer deposits and one lode deposit on a quartz-filled shear zone. Residents in the area report that chromite occurs at the head of Big French Creek, but none was found during our study.

The part of the North Fork of the Trinity River within area MM is accessible only by trail and is about 63,000 ft (18,900 m) long. The elevation is about 2,500 ft (750 m) at its entrance into the area and about 1,400 ft (420 m) at its exit; the river gradient is about 90 ft per mile (17 m/km).

Recent placer mining activity has been concentrated on stream-channel deposits, which overlie both intrusive and metamorphic rocks. Locally, the metamorphic rocks are intensely fractured and in places finely bedded, making good gold traps. Stream deposits on the Lotus 1 and 2 and Dan Raymond placers are being worked with small portable suction dredges. Operations of the Lotus 1 and 2 produced 2 oz (62 g) of coarse gold during the summer of 1973.

Five partly mined bench deposits occur along the North Fork of the Trinity River (table 4). The bench gravel is 10–33 ft (3–10 m) thick

TABLE 4.—*Principal placer deposits in area MM*

Name of deposit	Extent (acres)	Volume (cu yd)	Range of gold values (cents per cu yd)[1]	Number of samples	Average gold content in samples (cents per cu yd)[2]
Dan Raymond placer, bench deposits	2.7	50,000	<0.3 - 8.6	10	1.0
Raymond Gulch placer, bench deposits	3.3	5,000	<.3	1	<.3
Waldorff Crossing placer, bench deposits	1.1	45,000	71.3 - 116.6	2	109.3
Baxter Gulch placer, bench deposits	1.6	71,000	<.3 - 220.9	3	110.7
Lotus 1 and 2 placer, bench deposits	2.5	43,000	<.3 - 23.3	5	16.3
North Fork stream deposits[3]	174	2,520,000	<.3 - 964.3	6	315.7
Total	185.2	2,734,000	---	---	---

[1]The cents per cubic yard value is based on a gold price of $150 per troy oz. One cent per cubic yard equals 0.0027 gram per cubic meter.
[2]Weighted by sample length.
[3]Includes all stream gravel along streams in study area, claimed and unclaimed.

and rests on bedrock 5–30 ft (1.5–10 m) above present stream level. The gravel is well rounded, compact, and slightly iron oxide stained and in places contains clay lenses as well as boulders up to 10 ft (3 m) in diameter. The gravel is composed of 80–90 percent metamorphic rocks and 10–20 percent intrusive rocks.

The bench deposits contain about 116,000 cubic yards (89,000 m^3) of minable or paramarginal gravel resources, averaging 112 cents in gold per cubic yard.

The Busted Shoestring deposit, the only known lode deposit in area MM, is a quartz-filled shear zone containing about 9,000 tons (8,000 tonnes) of submarginal gold and silver resources.

PLACERS

LOTUS 1 AND 2 PLACERS

The Lotus 1 and 2 (fig. 5, Nos. 15 and 16) placers consist of two tree- and brush-covered benches and about 3,000 ft (900 m) of stream-channel deposits (figs. 12 and 13).

The current owners are mining the stream-channel deposits. Bedrock along the stream channel near the high-water mark was washed clean of gravel by high water and gold contained in the gravel was deposited in bedrock crevices. The stream channel at the Lotus 1 and 2 contains about 80,000 cubic yards (61,000 m^3) of gold-bearing gravel. One hundred and fifty cubic yards mined in the channel in 1973 averaged 417 cents in gold per cubic yard; remaining pockets are minable by small-scale methods.

Gravel on the two benches averages 10 ft (3 m) in thickness. It is

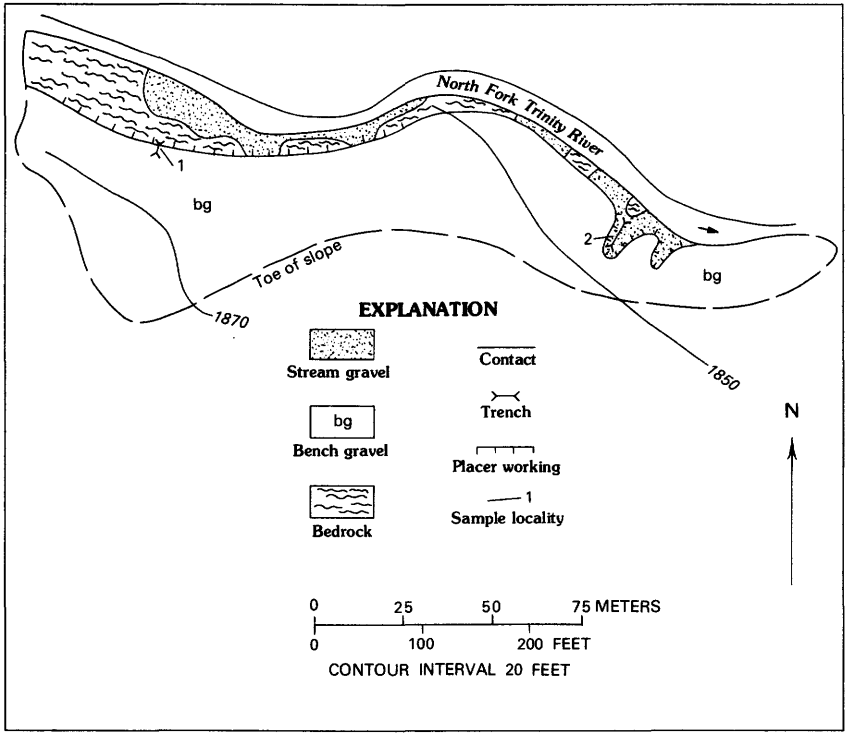

FIGURE 12.—Lotus 1 placer.

Data for samples from localities shown in figure 12

Locality	Depth Interval (feet)	Sample volume (cu ft)	Gold content (cents per cu yd)[1]	Black sand (pounds per cu yd)	Remarks
1	0- 6	3	2.2	0.8	Bench gravel and bedrock
	6- 8	4	<.3	.7	Bedrock
2	0-17	17	<.3	.4	Bench gravel
	17-17.5	1.2	16.6	4.4	Bench gravel and bedrock

[1]Calculated using a gold price of $150 per troy oz. One cent per cubic yard equals 0.0027 gram per cubic meter.

compact, well rounded, sandy, and contains angular boulders a maximum of 10 ft (3 m) in diameter. The benches are 40 percent mined. A sample from a 10-ft-long (3 m) cut on the Lotus 2 claim averaged 23.3 cents in gold per cubic yard and yielded 5.9 pounds of black sand per cubic yard (2 kg/m^3). Five samples from Lotus 1 and 2 indicate that the 43,000 cubic yards (33,000 m^3) in the placer averages 16.3 cents in gold per cubic yard.

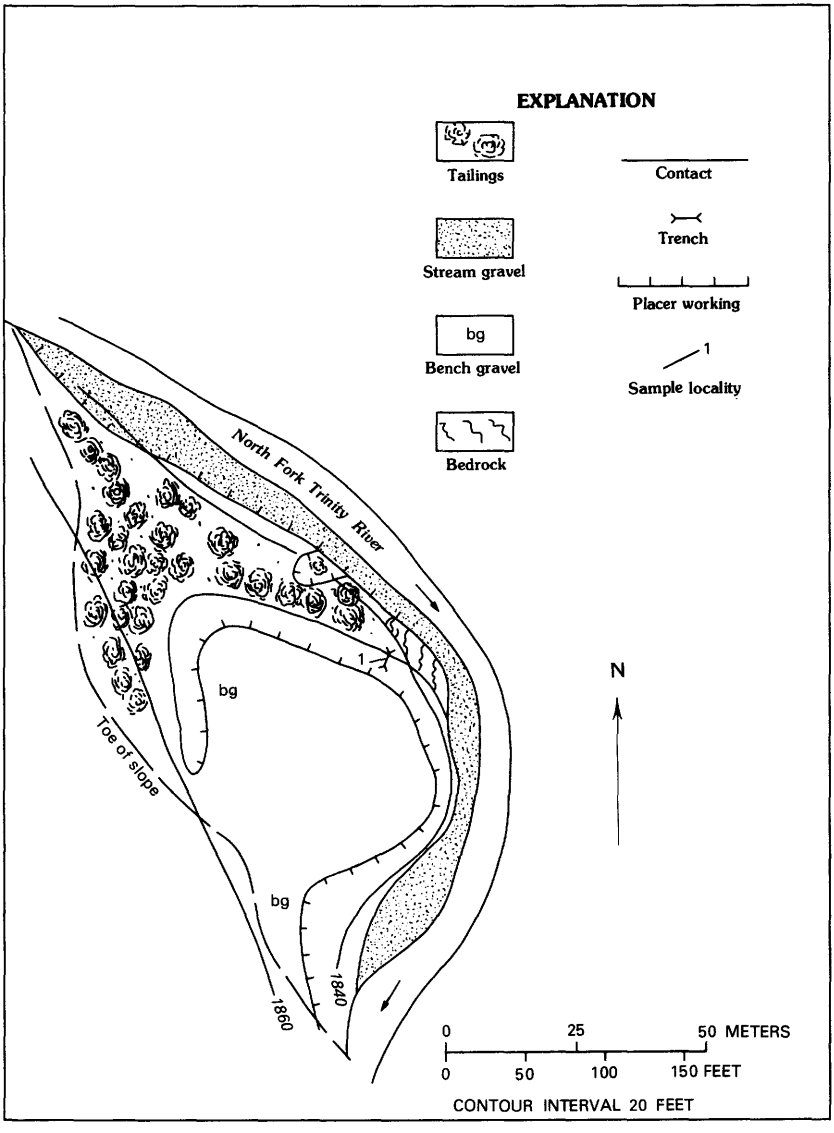

FIGURE 13.—Lotus 2 placer.

DAN RAYMOND PLACER

The Dan Raymond placer (fig. 5, No. 10) consists of a bench deposit and 3,000 ft (900 m) of stream-channel deposits (fig. 14). The owner mines bedrock crevices in the stream channel with a suction dredge during the summer months and mines bench gravel by hydraulic methods when water is available at other times of the year.

The stream channel contains about 80,000 cubic yards (61,000 m^3)

of gravel. Samples indicate that pockets contain as much as 964 cents in gold per cubic yard. About 15 percent of the gravel is estimated to be economically minable on a small scale.

Nearly all of the tree- and brush-covered bench has been mined. The remaining gravel is adjacent to steep slopes and is partly covered by talus. It has an average thickness of approximately 12 ft (3.6 m) and is composed of compact, iron oxide-stained, clayey gravel containing boulders up to 10 ft (3 m) in diameter. The bench totals about

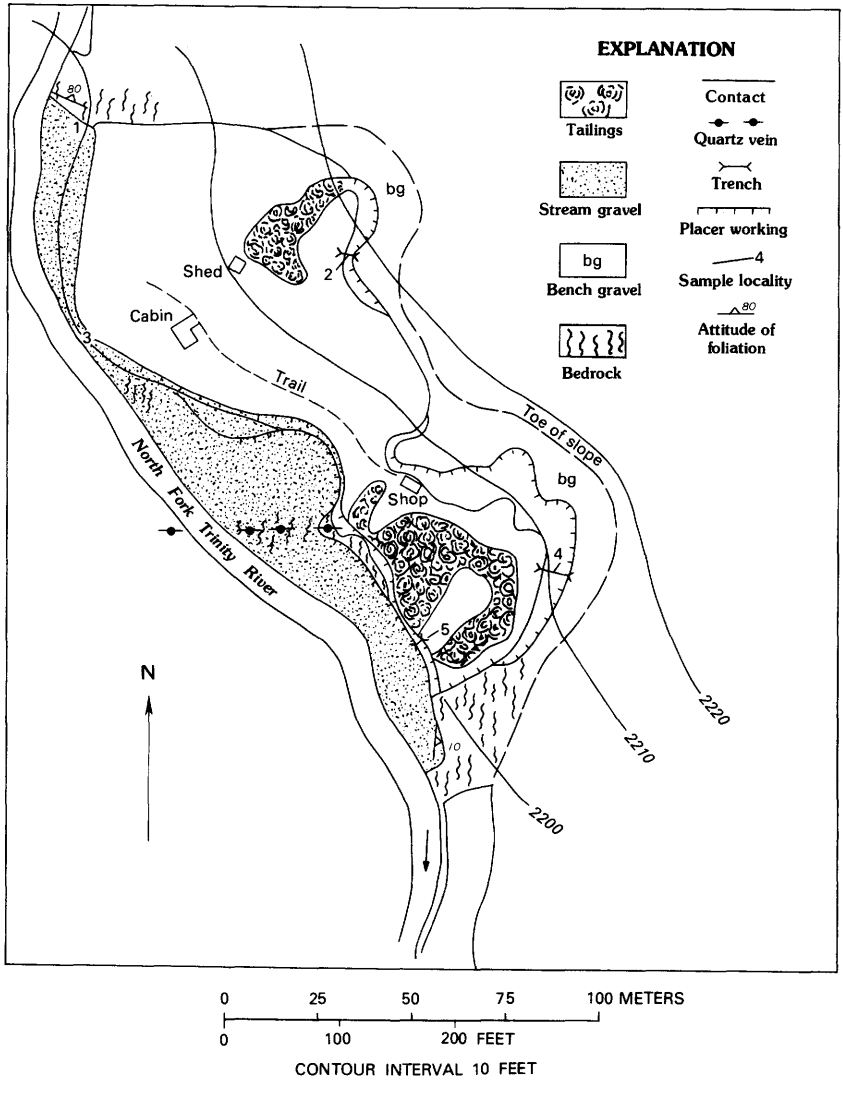

FIGURE 14.—Dan Raymond placer.

Data for samples from localities shown in figure 14

Locality	Depth Interval (feet)	Sample volume (cu ft)	Gold content (cents per cu yd)[1]	Black sand (pounds per cu yd)	Remarks
1	0 - 1.5	1.5	1.7	2.5	Bench gravel
	1.5- 3.0	1.5	1.7	1.4	Do.
	3.0- 4.0	1.0	1.3	3.3	Bedrock
2	0 - 2	2.0	<.3	.7	Bench gravel
	2 - 7	5.0	<.3	.7	Do.
	7 - 8.5	1.5	8.6	1.3	Bench gravel and bedrock
3	0 - .5	2.5	394.7	4.2	Select sample of stream gravel
	0 - .5	3.0	964.3	3	Do.
4	0 -16	16	.7	.8	Bench gravel
	16 -21	5	.6	.6	Do.
5	1 - 3.5	2.5	<.3	1.4	Bench gravel
	3.5- 4.5	1	<.3	4.1	Bench gravel and bedrock

[1]Calculated using a gold price of $150 per troy oz. One cent per cubic yard equals 0.0027 gram per cubic meter.

50,000 cubic yards (38,000 m^3 gravel. Samples averaged about 1.5 cents per cubic yard in gold.

Above the bench, metamorphic bedrock is in contact with serpentine. Red soil, weathered from the serpentine-metamorphic contact, contains 1.5 cents in gold per cubic yard.

BAXTER GULCH PLACER

The Baxter Gulch placer (fig. 5, No. 14) is a flat, tree- and brush-covered bench deposit southeast of the mouth of Baxter Gulch (fig. 15).

The deposit consists of 33 ft (10 m) of well-rounded, bouldery, compact, iron oxide-stained gravel containing clay lenses. Clay makes up 10 percent and boulders make up to 20 percent of the deposit. The gravel rests on metamorphic bedrock. Samples taken of bench gravel

Data for samples from localities shown in figure 15

Locality	Depth Interval (feet)	Sample volume (cu ft)	Gold content (cents per cu yd)[1]	Black sand (pounds per cu yd)	Remarks
1	0-33	16.5	220.9	0.2	Bench gravel
	33-33.5	.5	138.4	4.1	Bench gravel and bedrock
2	8- 9	1.0	<.3	1.5	Do.

[1]Calculated using a gold price of $150 per troy oz. One cent per cubic yard equals 0.0027 gram per cubic meter.

indicate that gold is concentrated in or above clay lenses, as well as near bedrock. The samples averaged 111 cents in gold per cubic yard. The 71,000 cubic yards (54,000 m^3) of gravel may be minable.

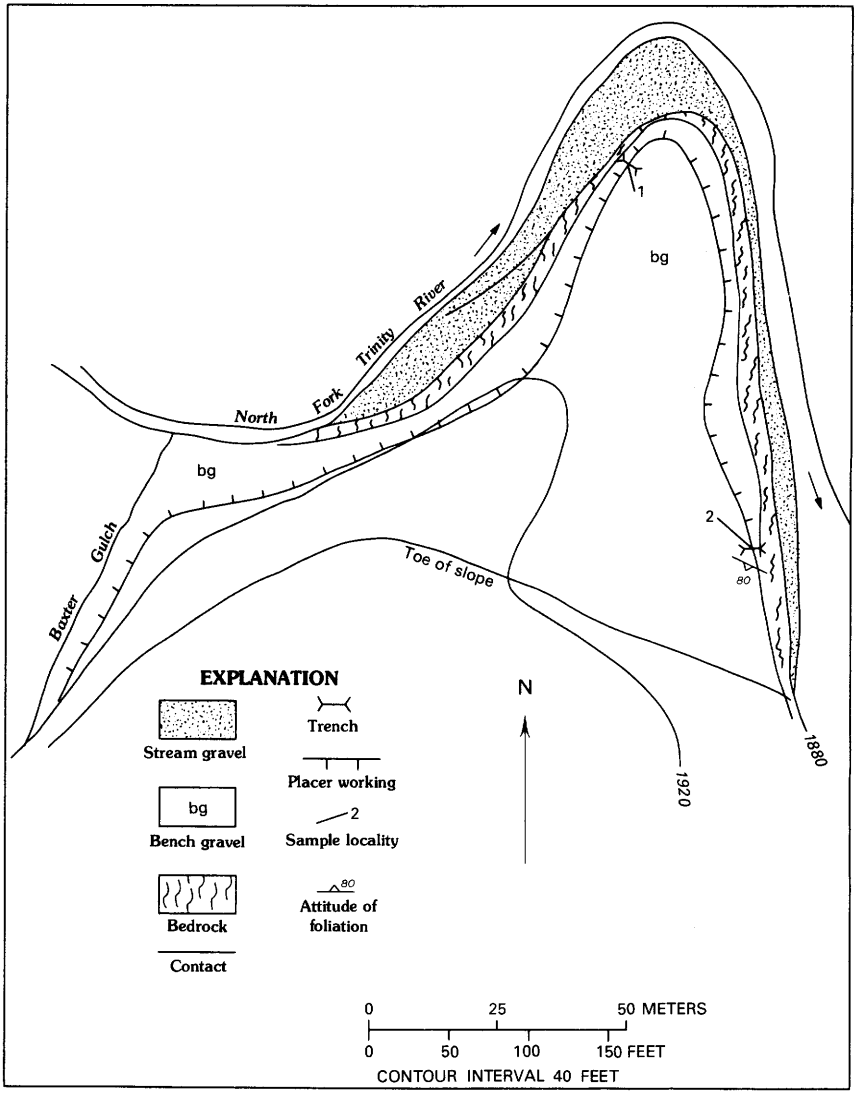

FIGURE 15.—Baxter Gulch placer.

WALDORFF CROSSING PLACER

The Waldorff Crossing placer (fig. 5, No. 13), which lies on the opposite side of the North Fork of the Trinity River from the Baxter Gulch placer, is a flat tree- and brush-covered bench (fig. 16) that has

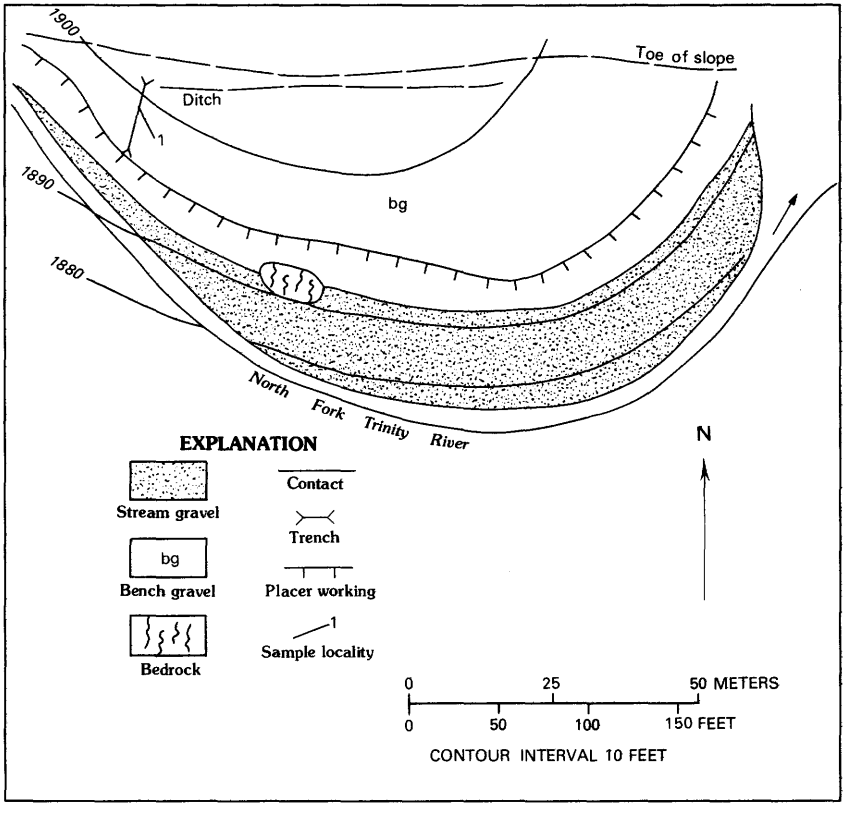

FIGURE 16.—Waldorff Crossing placer.

Data for samples from localities shown in figure 16

Locality	Depth Interval (feet)	Sample volume (cu ft)	Gold content (cents per cu yd)[1]	Black sand (pounds per cu yd)	Remarks
1	0-4	0.5	116.6	4.8	Bench gravel
	4-4.5	2.0	71.3	1.2	Bench gravel and bedrock

[1]Calculated using a gold price of $150. per troy oz. One cent per cubic yard equals 0.0027 gram per cubic meter.

been partly mined. Most of the remaining gravel occurs on the upstream end of the bench. It is 2–4 ft (0.6–1.2 m) thick and is composed of well-rounded, compact, bouldery gravel that rests on intensely fractured metamorphic bedrock. The surface of the bedrock is 10–20 ft (3–6 m) above the present stream level.

The samples indicate that gold is distributed uniformly throughout the gravel. They averaged 112 cents in gold per cubic yard. The deposit contains 45,000 cubic yards (34,000 m^3) that may be economically minable.

NORTH FORK GULCH PLACERS

A group of eight placer claims is located on stream-channel deposits along the North Fork of the Trinity River, near North Fork Gulch. The claims (fig. 5, No. 17) extend up North Fork Gulch, up the North Fork of the Trinity River for about three-quarters of a mile (1.2 km), and down the North Fork for about 1 mile (1.6 km).

The stream channel in the area claimed is estimated to contain about 246,000 cubic yards (188,000 m^3) of gravel. Four select samples from these stream-channel deposits contained from less than 0.3 cent to 356 cents in gold per cubic yard. Pockets that may be minable by small-scale methods are estimated to total 20,000 cubic yards (15,700 m^3). They may average 149 cents in gold per cubic yard.

RAYMOND GULCH PLACER

The Raymond Gulch placer (fig. 5, No. 11) is located opposite the Dan Raymond placer. It is a flat, tree- and brush-covered bench that has been 95 percent mined. The remaining 5,000 cubic yards (4,000 m^3) of gravel in the deposit is estimated to contain less than 0.2 cent in gold per cubic yard.

LODE

THE BUSTED SHOESTRING LODE

Known lode mineral resources of area MM are contained in the Busted Shoestring deposit (fig. 5, No. 12). The property consists of six lode mining claims which are about 9.5 miles (15 km) by road from Helena, Calif. The property is reported by local residents to have produced a few ounces of gold from 3 to 5 tons (3–5 tonnes) of ore. Oxidized surficial ore was mined by hand and the gold recovered by grinding the ore in a small manually operated mill, and panning the mill product.

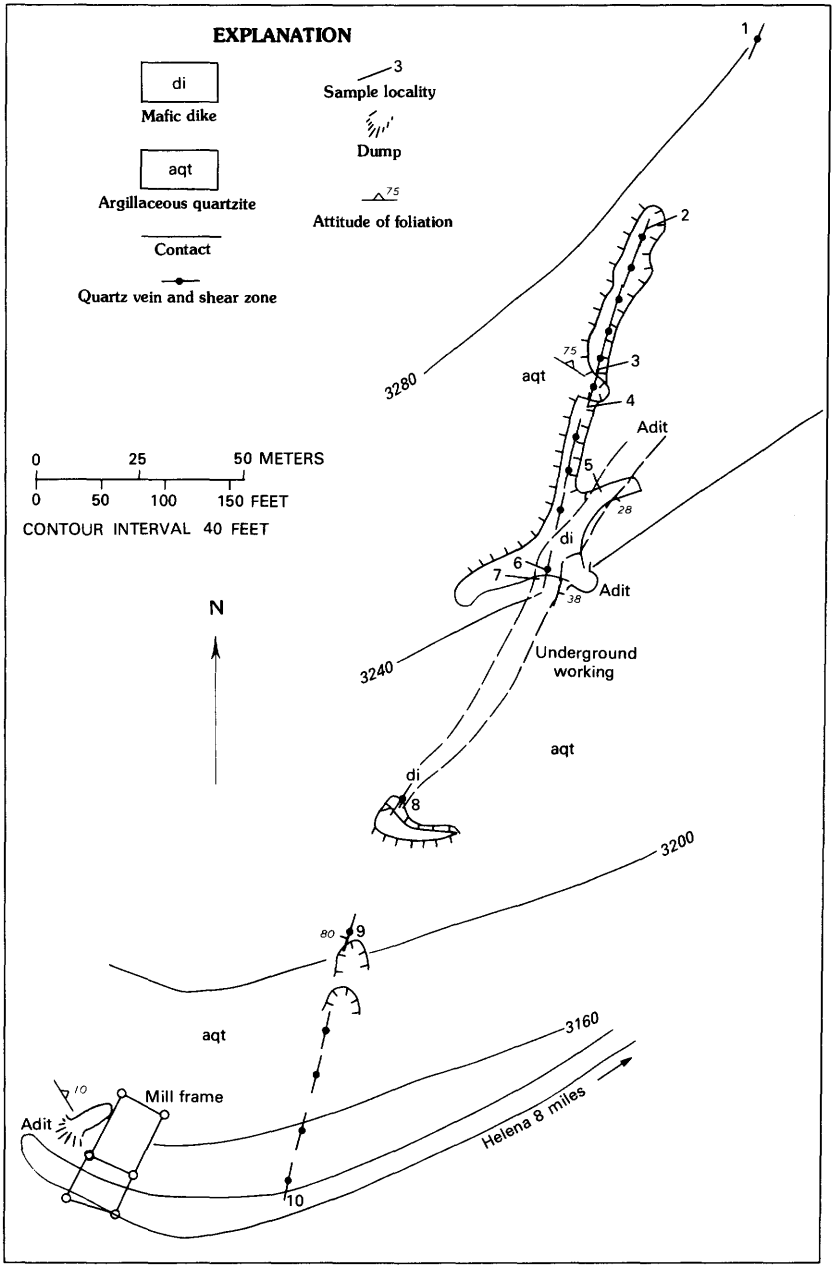

FIGURE 17.—Busted Shoestring lode.

Data for samples from localities shown in figure 17

[Tr, trace; N, none detected]

No.	Type	Sample Length (feet)	Description	Gold (ounce per ton[1]	Silver (ounce per ton[1]
1	Chip	2	Across vein and shear zone	0.02	0.1
2	Do.	1.5	do.	.01	.1
3	Do.	1.5	do.	.48	.1
4	Do.	2	do.	.16	.1
5	Do.	10	Across dike	.01	.2
6	Do.	1	Across vein	N	Tr
7	Do.	8	Across shear zone	.01	.1
8	Do.	4	Across dike and shear zone	.02	Tr
9	Do.	3	Across shear zone	N	N
10	Do.	3.5	do.	N	N

[1]One ounce per ton equals 34.3 grams per tonne.

Workings are on a 1.5– to 8-ft-thick (0.5–2.4 m) shear zone striking N. 15° E., and dipping 70° to 90° in fine-grained, thin-bedded, intensely fractured, iron and manganese oxide-stained, argillaceous quartzite striking N. 15° to 25° W., and dipping 75° NE. (fig. 17). The shear zone also cuts an 8-ft-thick (2.4 m), altered, iron oxide-stained, mafic dike that strikes N. 40° E., and dips 60° SE. Small stringers of dike rock project out from the dike into the country rock, commonly along bedding planes. The shear zone is partly filled by a quartz vein 4 inches to 2-ft thick (0.1–0.6 m) composed of fine-grained, vuggy, white quartz, 5 percent limonite-hematite, and less than 5 percent pyrite.

The shear zone is exposed by the workings over a length of 380 ft (116 m). Dense manzanita and pine brush, and up to 8 ft (2.4 m) of soil and talus cover the possible extensions of the shear zone. The shear zone is estimated to contain a submarginal resource of 9,000 tons (8,000 tonnes) that averages 0.08 oz gold per ton (2.7 g per tonne) and 0.1 oz silver per ton (3 g per tonne).

AREA E

The mineral resources of area E consist of gold-bearing bench and stream-channel placer deposits located along about 9,000 ft (2,700 m) of New River (table 5). The river enters area E at an elevation of about 2,000 ft (600 m) and exits at an elevation of about 1,840 ft (550 m); it has a gradient of about 94 ft per mile (17 m per km).

Area E was mapped by the U.S. Geological Survey (Hotz and others, 1972) during the study of the Salmon-Trinity Alps Primitive Area, but was not studied by the Bureau of Mines at that time. The

TABLE 5.—*Principal placer deposits in area E*

Name of deposit	Extent (acres)	Volume (cu yd)	Range of gold values (cents per cu yd)[1]	Number of samples	Average gold content in samples (cents per cu yd)[2]
Virgin Creek placer, bench deposits	0.8	12,000	<0.3 - 2739.1	3	186.6
Shield placer, bench deposits--	.2	6,000	259.5	1	259.5
Dot placer, bench deposits-----	3.4	165,000	18.5 - 29.9	3	14.6
State placer, bench deposits---	1.6	26,000	4.4 - 6.7	2	5.8
Barron Creek placer, bench deposits	3.8	92,000	<.3 - 25.9	5	16.6
New River stream deposits[3]-----	25	242,000	<.3 - 417.6	10	237.2
Total----------	34.8	543,000	---	---	---

[1]The cents per cubic yard is based on a gold price of $150 per troy oz. One cent per cubic yard equals 0.0027 gram per cubic meter.

[2]Weighted by sample length.

[3]Includes all stream gravel along stream in study area, claimed and unclaimed.

stream cuts altered metamorphic bedrock, which locally is thinly bedded, intensely fractured, and thus is a good gold trap. Recent placer mining activity has consisted of the mining of stream-channel bedrock deposits with small suction dredges.

Five partly mined bench-gravel deposits, accessible only by trail, occur along New River in area E. All are currently held by location. The gravel on the benches is 12 to 30 ft (3.6–10 m) thick and rests on bedrock 2–20 ft (0.6–6 m) above the present stream level. The gravel is well rounded, contains clay lenses, and has boulders up to 10 ft (3 m) in diameter. It consists of 60–70 percent of metamorphic rocks and 30–40 percent of intrusive rocks. Gold occurs on or within 2 ft (0.6 m) of bedrock, although some lies above some of the clay lenses.

Benches in area E contain about 301,000 cubic yards (230,000 m^3) of gravel averaging approximately 26 cents in gold per cubic yard. Small pockets, however, contain as much as 2,741 cents in gold per cubic yard. There also is about 242,000 cubic yards (185,000 m^3) of channel gravel. Channel pockets may contain as much as 418 cents in gold per cubic yard, but samples from bedrock averaged 2,380 cents in gold per cubic yard. About 15 percent of the channel gravel is estimated to be economically minable.

DOT PLACER

The Dot placer (fig. 5, No. 7) is a tree- and brush-covered bench deposit resting on bedrock 15–20 ft (4.5–6 m) above the present stream level (fig. 18). The gravel averages 30 ft (10 m) in thickness and is partly cemented, clayey, and slightly stained with iron oxide; it

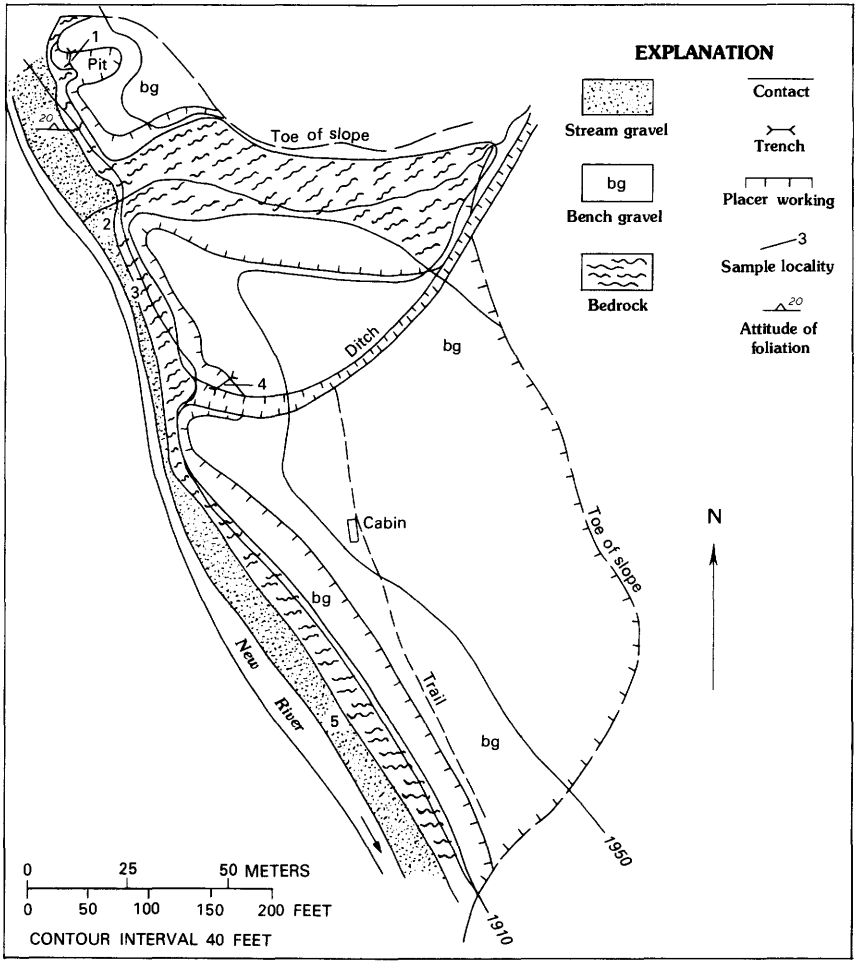

FIGURE 18.—Dot placer.

Data for samples from localities shown in figure 18

Locality	Depth Interval (feet)	Sample volume (cu ft)	Gold content (cents per cu yd)[1]	Black sand (pounds per cu yd)	Remarks
1	0- 0.5	0.4	26.5	2.4	Bench gravel and bedrock
2	0- .5	.7	86.3	6.9	Select sample of stream gravel
3	0- .5	.8	405.6	3.7	Do.
4	0-34	2.0	13.9	2.3	Bench gravel
	34-34.5	2.0	29.9	2.2	Bench gravel and bedrock
5	0- .5	.7	18.5	4.4	Select sample of stream gravel

[1]Calculated using a gold price of $150 per troy oz. One cent per cubic yard equals 0.0027 gram per cubic meter.

contains up to 30 percent boulders. The deposit contains a submarginal resource of about 165,000 cubic yards (126,000 m^3) of gravel. Samples, weighted by length, averaged 10 cents in gold per cubic yard.

BARRON CREEK PLACER

Barron Creek placer (fig. 5, No. 9), opposite the mouth of Barron Creek, is a flat, tree- and brush-covered bench deposit that is up to 15 ft (4.5 m) thick (fig. 19). The well-rounded, compact, bouldery gravel making up the deposit rests on metamorphic bedrock.

The toe of Barron Creek placer was mined or was washed away by high water. The remaining bench gravel totals 92,000 cubic yards (70,000 m^3). Samples averaged 16.6 cents gold per cubic yard.

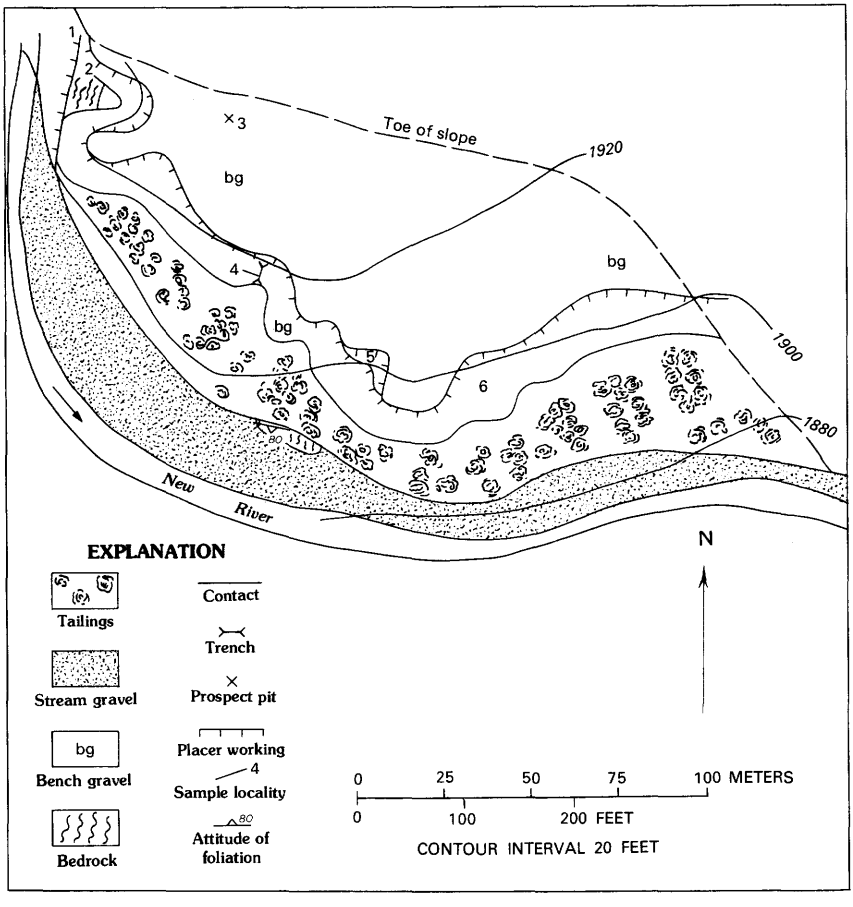

FIGURE 19.—Barron Creek placer.

Data for samples from localities shown in figure 19

Locality	Depth Interval (feet)	Sample volume (cu ft)	Gold content (cents per cu yd)[1]	Black sand (pounds per cu yd)	Remarks
1	0- 0.5	0.6	352.7	7.7	Select sample of stream gravel
2	0- .5	.2	25.9	1.7	Bench gravel and bedrock
3	0- 8	.5	<.3	2.2	Bench gravel
4	0-24	.3	21.7	1.1	Bench gravel and bedrock
5	0- 9	.4	<.3	.8	Do.
6	0- .5	.5	<.3	3.8	Do.

[1]Calculated using a gold price of $150 per troy oz. One cent per cubic yard equals 0.0027 gram per cubic meter.

STATE PLACER

The State placer (fig. 5, No. 8) consists of two tree- and brush-covered bench deposits on opposite sides of New River and about 1,500 ft (450 m) of stream channel deposits (fig. 20).

The south bench has been partly mined and the north bench has been completely mined. The south bench, a point-bar deposit, is covered by 8 ft (2.4 m) of compact, iron-stained gravel, which rests on a bedrock bench 5 ft (1.5 m) above the present stream level. It contains boulders up to 4 ft (1.2 m) in diameter. The bench contains 26,000 cubic yards (20,000 m^3) of gravel, samples of which averaged 5.8 cents in gold per cubic yard. The stream channel may contain about 40,000 cubic yards (31,000 m^3) of gravel. Pockets of stream gravel may contain as much as 58.3 cents in gold per cubic yard.

Data for samples from localities shown in figure 20

Locality	Depth Interval (feet)	Sample volume (cu ft)	Gold content (cents per cu yd)[1]	Black sand (pounds per cu yd)	Remarks
1	1-7	6	4.4	0.3	Bench gravel
	7-7.5	3	6.7	1.4	Bench gravel and bedrock
2	0- .5	1	58.5	3.7	Select sample of stream gravel

[1]Calculated using a gold price of $150 per troy oz. One cent per cubic yard equals 0.0027 gram per cubic meter.

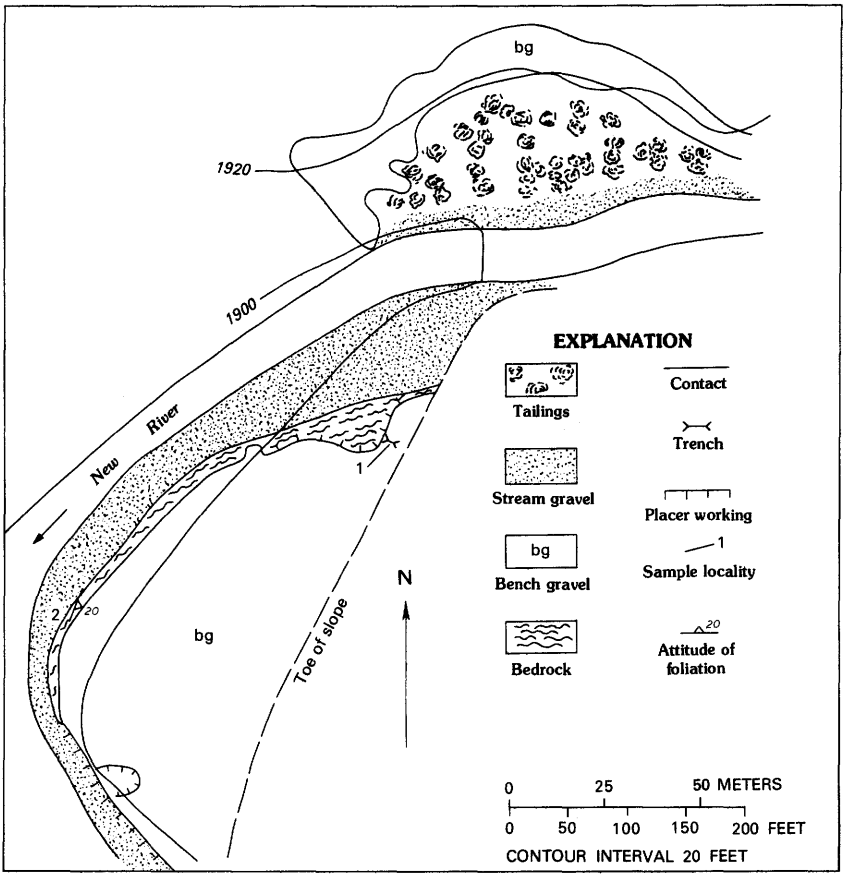

FIGURE 20.—State placer.

VIRGIN CREEK PLACER

The Virgin Creek placer (fig. 5, No. 5) is on the south side of the junction of Virgin Creek and New River (fig. 21). The tree- and brush-covered bench deposit rests on metamorphic bedrock 5–12 ft (1.5–3.6 m) above the present stream level and has been mostly mined. The remaining gravel is 7–10 ft (2.1–3 m) thick; it is well rounded, containing boulders 0.5–3 ft (0.2–1 m) in diameter.

This placer contains about 12,000 cubic yards (9,000 m^3) of gravel. Samples of bench gravel, exclusive of those on bedrock, contained a maximum of 4.4 cents in gold per cubic yard. Samples from bedrock, however, contained as much as 2,741 cents per cubic yard; therefore, pockets scattered in the bench and stream gravel may be economically minable on a small scale.

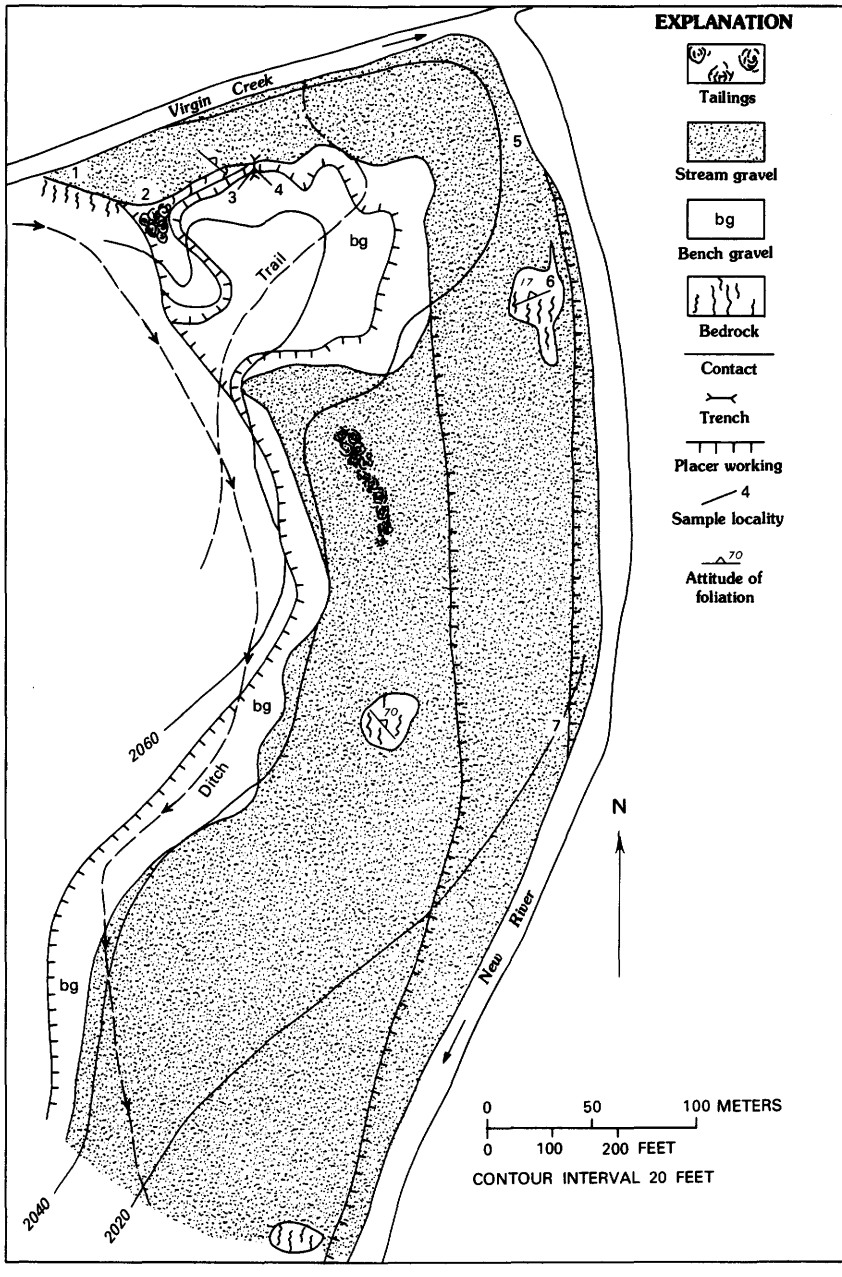

FIGURE 21.—Virgin Creek placer.

Data for samples from localities shown in figure 21

Locality	Depth Interval (feet)	Sample volume (cu ft)	Gold content (cents per cu yd)[1]	Black sand (pounds per cu yd)	Remarks
1	0–0.5	0.1	<0.3	15.1	Select sample of stream gravel
2	0– .5	.2	64.9	10.6	Do.
3	0–6	6	4.4	.6	Bench gravel
	6–7	1	<.3	3.7	Bench gravel and bedrock
4	0– .5	.6	2739.1	11.4	Do.
5	0– .5	.2	<.3	1.7	Select sample of stream gravel
6	0– .5	.7	417.6	13.8	Do.
7	0– .5	.2	90.9	8.6	Do.

[1]Calculated using a gold price of $150 per troy oz. One cent per cubic yard equals 0.0027 gram per cubic meter.

SHIELD PLACER

The Shield placer (fig. 5, No. 6) consists of a flat, tree-covered bench deposit that is 50 percent mined. The remaining 6,000 cubic yards (5,000 m^3) of gravel is 10 ft (3 m) thick and rests on metamorphic bedrock, 15–20 ft (4.5–6 m) above the present stream level. The gravel is well rounded, compact, clayey, and slightly stained by iron oxide; it contains 30 percent boulders. A sample from the bedrock surface indicates that select portions of the deposit may average as much as 178 cents in gold per cubic yard and may be minable on a small scale.

AREA LL

The mineral resources of area LL are in three altered zones and small quartz veins along contacts between igneous and sedimentary rocks. Gold, copper, cinnabar, and chromite prospects are present a short distance beyond the western edge of area LL, but no extensions of these particular mineralized structures were found within it. The mineral resource potential of the altered zones and quartz veins is considered low.

The lower end of Red Cap Creek, outside area LL, was extensively placered in the past, but no placer resources are known to occur within area LL. The portion of Red Cap Creek within area LL is about 34,000 ft (10,000 m) long. The creek heads in the area at an elevation of about 4,400 ft (1,300 m) and exits at an elevation of about 1,000 ft

(300 m). The stream has a gradient of about 530 ft per mile (100 m per km). A select stream sample from Red Cap Creek contained less than 0.3 cent of gold, 5.9 lb of black sand per cubic yard (3.5 kg/m^3), and 0.6 lb of magnetite per cubic yard (0.4 kg/m^3).

KUBLIA GOLD PROSPECT

The Kublia gold prospect (fig. 5, No. 1), accessible by road from Orleans, Calif., consists of six shallow exploration pits, a trench, and a caved adit, all within an area of about a quarter of a square mile (0.6 km^2).

The six shallow exploration pits, on the southwestern end of the area, are in overburden, and no bedrock or mineralized structures are exposed. Iron oxide-stained hornblende diorite occurs in the dumps, but it contains no economic quantities of metallic elements.

A trench and caved adit, about a quarter of a mile (0.4 km) northwest of the pits, expose a 4-inch-wide (10 cm) quartz vein along the contact between a 4-ft-wide (1.2 m) olivine dike and hornblende diorite country rock. The vein and dike trend N. 54° W., and dip vertically. The vein consists of massive milky white quartz and some scattered stains and concentrations of malachite. Samples from the vein contained 0.2 oz silver per ton (7 g per tonne), 0.01 percent copper, and a trace of gold.

SALMON MOUNTAIN PROSPECT

The Salmon Mountain prospect (fig.5, No. 2) consists of two shallow exploration pits. One pit is in overburden and exposes no mineralized rock. Material on its dump indicates that it extended into diorite country rock, which is cut by a quartz-calcite vein less than 6 inches (15 cm) thick. The vein contains less than 5 percent pyrite. A sample contained no significant quantities of economic metallic elements.

The other pit exposes a 5.5-ft-wide (1.7 m), iron oxide-stained shear zone trending N. 60° W., and dipping vertically in a small roof pendant of greenstone. The shear zone, which consists of brecciated greenstone and less than 5 percent iron oxides, is exposed for 50 ft (15 m). Possible extensions of the zone are covered by as much as 2 ft (0.6 m) of overburden. A sample contained only traces of silver and copper.

RED CAP LAKE PROSPECT

The Red Cap Lake prospect (fig. 5, No. 3) consists of shallow trenches along an altered, iron oxide-stained contact zone between metasedimentary rocks and hornblende diorite. The zone is 5 ft wide

(1.5 m), trends N. 45° W., and dips 77°; it is exposed for a distance of 150 ft (46 m). A sample across the zone contained a trace of silver and 0.01 percent copper.

DEVILS BACKBONE PROSPECT

The Devils Backbone prospect (fig. 5, No. 4) consists of a shallow exploration pit in hornblende diorite. No mineral-bearing structures are exposed. A sample of the diorite contained 0.01 percent copper.

AREA OO

No mining claims have been located within area OO and no mineralized areas were found. Limestone occurs along the western boundary of the area, but it is too far from potential markets to be of economic importance.

CONCLUSIONS

Except for limited production of gold from small placer deposits, the areas examined in this study have a small mineral potential. Only very small amounts of gold have been produced from the few known lode deposits. Geochemical sampling failed to reveal any evidence that the areas studied include any potentially important undiscovered mineral resources.

All placer gold resources are in areas NN, MM, and E, and they will continue to produce small amounts of placer gold. The few successful placer miners have shown that small quantities of gold can be recovered from pockets. High placer gold values in areas NN, MM, and E will continue to attract the serious individual miners and also the hobbyist seeking recreation and a pretty piece of gold.

About 3.7–5 million cubic yards (2.8 million m^3) of gravel are estimated to occur within the areas studied. Of this, about 3 million cubic yards (2.3 million m^3) are stream channel deposits, and pockets in them may contain as much as 2,741 cents in gold per cubic yard. About 749,000 cubic yards (573,000 m^3) are bench deposits, of which about 314,000 cubic yards (240,000 m^3) are minable or paramarginal and contain between 50 cents and 1,820 cents in gold per cubic yard. Pockets in the bench deposits contain as much as $340.60 in gold per cubic yard.

Lode gold and silver resources, principally in areas NN and MM, consist of vein quartz totaling about 14,000 tons (12,600 tonnes). The vein material averages 0.05 oz gold and 0.2 oz silver per ton (2 g and 7 g per tonne). Local small concentrations of gold, as much as 0.34 oz

per ton (12 g per tonne) in lode samples, suggest that additional exploration in areas NN and MM might disclose similar minable gold deposits.

None of the areas that were examined have combustible fuels, and their potential for geothermal energy is low. Aside from deposits of limestone and sand and gravel, which, because of their distance from markets are not likely to be economically important, no nonmetallic resources were recognized in any of the areas.

REFERENCES CITED

Cox, D. P., 1967, Reconnaissance geology of the Helena quadrangle, Trinity County, California, *in* Short contributions to California geology: California Div. Mines and Geology Spec. Rept. 92, p. 43–55.

Davis, G. A., 1968, Westward thrust faulting in the south-central Klamath Mountains, California: Geol. Soc. America Bull., v. 79, no. 7, p. 911–934.

Davis, G. A., Holdaway, M. J., Lipman, P. W., and Romey, W. D., 1965, Structure, metamorphism, and plutonism in the south-central Klamath Mountains, California: Geol. Soc. America Bull., v. 76, no. 8, p. 933–966.

Engineering and Mining Journal, 1974, Metals week quotations: v. 175, no. 3, p. 54.

Hotz, P. E., Thurber, H. K., Marks, L. Y., and Evans, R. K., 1972, Mineral resources of the Salmon-Trinity Alps Primitive Area, California, *with a section on* An aeromagnetic survey and interpretation *by* Andrew Griscom: U.S. Geol. Survey Bull. 1371–B, 267 p.

Irwin, W. P., 1966, Geology of the Klamath Mountains province, *in* Bailey, E. H., ed., Geology of northern California: California Div. Mines and Geology Bull. 190, p. 19–38.

O'Brien, J. C., 1965, Mineral resources of Trinity County, California: California Div. Mines and Geology, County Rept. 4, 53 p.

Strand, R. G., compiler, 1963, Geologic map of California, Olaf P. Jenkins edition, Weed sheet: California Div. Mines and Geology, scale 1:250,000.

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