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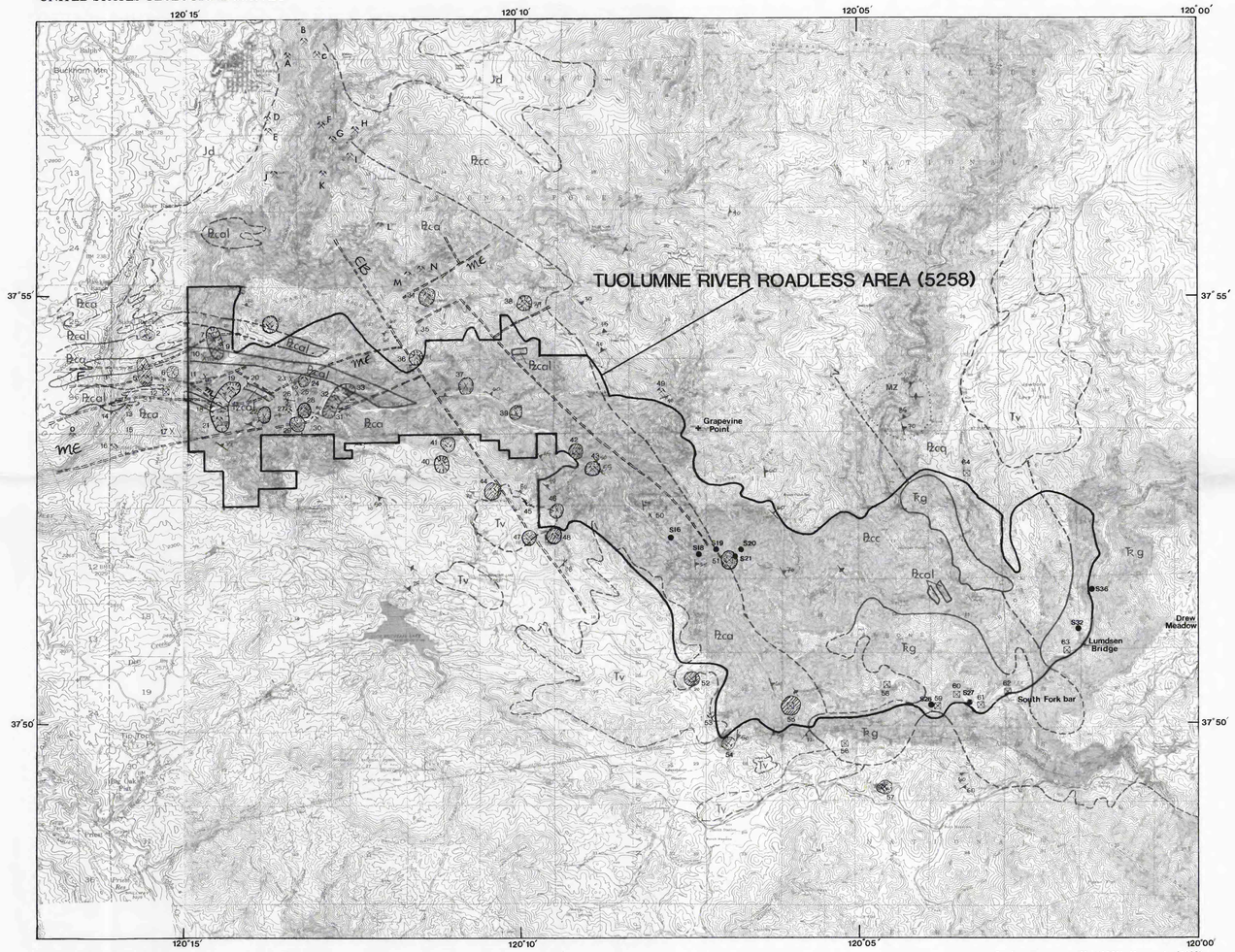

MINERAL RESOURCE POTENTIAL MAP OF THE TUOLUMNE RIVER ROADLESS AREA, TUOLUMNE COUNTY, CALIFORNIA

By

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EXPLANATION

- AREA WITH IDENTIFIED LOW POTENTIAL FOR GOLD RESOURCES
- AREA WITH LOW TO MODERATE POTENTIAL FOR GOLD RESOURCES--Based on occurrences of gold bearing shoots
- AREA WITH MODERATE TO HIGH POTENTIAL FOR GOLD RESOURCES--Based on production records and assay values
- AREA WITH LOW POTENTIAL FOR GOLD RESOURCES--Based on production records and assay values
- LODE MINE--Number keyed to text and tables
- PLACER MINE--Number keyed to text and tables
- X LODE PROSPECT--Number keyed to text and tables
- PLACER PROSPECT--Number keyed to text and tables
- S16 AREA OF GEOCHEMICAL ANOMALIES
- VEIN SYSTEMS
  - EB East belt
  - ME Mary Ellen
  - F Florida
  - M Mohican

CORRELATION OF MAP UNITS

Tv		TERTIARY	CENOZOIC
Jd	Upper Jurassic	JURASSIC	MESOZOIC
Tkg	Middle and Lower Triassic	TRIASSIC	
Calaveras Complex of Schweickert and others (1977) Pzcq	Upper Permian	PERMIAN	UPPER PALEOZOIC
Calaveras Complex of Schweickert and others (1977) Pzcc	Upper Permian	PERMIAN	UPPER PALEOZOIC
Calaveras Complex of Schweickert and others (1977) Pzca	Upper Permian	PERMIAN AND CARBONIFEROUS	UPPER PALEOZOIC

DESCRIPTION OF MAP UNITS

Tv VOLCANIC ROCKS (TERTIARY)--Red andesite porphyry and gray dacite with quartz and amphibole crystals; some vesicular textures. Also meta-andesite, mafic volcanic breccia with volcanic clasts, and pyroclastic rocks. May be correlative with the Mehrten Formation

Jd DIORITE (UPPER JURASSIC)--Fine- to medium-grained, equigranular diorite ranging in composition to granodiorite. Contains biotite and predominantly hornblende up to 50 percent combined. Contact zones between the diorite and the Calaveras Complex of Schweickert and others (1977) exhibit foliated textures, mixed rocks composed of diorite, quartzite and argillite, and diorite enclosing blocks of quartzite up to several feet long. Includes white clay zones. Numerous diorite dikes with abundant biotite cut the metasedimentary rocks of the Calaveras Complex and are deformed with the metasedimentary rocks

Tkg GRANODIORITE (MIDDLE AND LOWER TRIASSIC)--Typically massive, medium to coarsely crystalline, equigranular granodiorite, (comprising the Standard pluton) with oligoclase-andesine, orthoclase, quartz, biotite, hornblende, and perhaps as much as 10 percent partially uralitized augite, a small amount of spatite, garnet, and hypersthene (Hart, 1959)

CALAVERAS COMPLEX OF SCHWEICKERT AND OTHERS (1977) (UPPER PALEOZOIC)--In this area divided into:

Pzcq Quartzite unit (Upper Permian)--Thick to thin, well bedded, and sometimes-graded predominantly quartzite, quartz sandstone, and shale, with lesser amounts of mica-quartz schist, interbedded chert, and phyllite. Local augen gneiss and mylonite near the contact of the quartzite unit with the chert unit. Much of the unit is iron stained, with fresh surfaces being gray, sometimes variegated in pink, yellow, gray and white. Some of the unit is locally foliated and contains compositional banding that grades into the gneissic and ptygmatic textures in the mylonite zone. Locally sheared. Some chert clasts enclosed in the quartzite lithology. Equivalent to the lower unit of the Shoo Fly Complex of Merguerian (1982). Age shown for unit is protolithic age

Pzcc Chert unit (Upper Permian)--Chert composed of microcrystalline quartz with small amounts of biotite and muscovite, massive to well bedded, sertated, slightly foliated; much ribbon chert, locally highly deformed. In places the chert shows conspicuous cleavage planes spaced 20 in. to 3 ft apart. Chert colors are white, blue gray, gray, pink, black, dull green; much of the chert is iron stained. Also includes small limestone bodies. Age shown for unit is protolithic age

Pzca Argillite (Permian and Carboniferous)--Argillite unit includes quartzite, mica quartzite, phyllite, mica-quartz schist, and interbedded chert and clay. Argillite unit composed of quartz, biotite, muscovite, magnetite, chlorite, garnet, epidote, andalusite, and pyrite. Massive to slightly foliated, locally porphyroblastic with rounded elongated quartz and chert clasts. Argillite unit strikes predominantly N 20-55 W, dips 60-80 NE, with much local variation. Age shown for unit is protolithic age. Locally, unit includes limestone and pyroclastic volcanic rocks:

Pzcal Limestone--Fine-, medium-, to coarse-grained, crystalline carbonate rocks composed of gradational zones of metamorphosed limestone, dolomite, and dolomitic limestone, with cross-hatched gray black streaks (graphite?). Locally the limestone is interbedded with chert and argillite along the ridge west of Big Creek. A chaotic limestone breccia composed of marble matrix with a variety of elongate clasts of quartzite occurs along the Tuolumne River near the confluence of Big Creek and the Tuolumne River. Actinolite-bearing patches and micaceous layers occur in the limestone. The limestone occurs predominantly in the argillite unit, and also in small lens masses in the chert unit. The bedding attitudes in the limestone tend to nearly parallel those in the other units of the Calaveras Complex

- CONTACT--Dashed where inferred
- STRIKE AND DIP OF FOLIATION: Inclined; Vertical
- STRIKE AND DIP OF VEIN OR DIKE: Inclined; Vertical
- (MZ) MYLONITE ZONE
- APPROXIMATE BOUNDARY OF ROADLESS AREA

STUDIES RELATED TO WILDERNESS

The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts require the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas on Federal lands to determine their mineral resource potential. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral resource potential survey of the Tuolumne River Roadless Area in the Stanislaus National Forest, Tuolumne County, California. Tuolumne River Roadless Area (5258) was classified as a further planning area during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

SUMMARY

Geological and geophysical studies conducted by the U.S. Geological Survey (USGS) and mine and prospect examinations and a geochemical study performed by the U.S. Bureau of Mines (USBM) indicate that a high resource potential exists for gold in the Tuolumne River Roadless Area, California. Four lode and three placer properties in and adjacent to the roadless area have identified subeconomic resources for gold. One marble prospect adjacent to the roadless area has marginal reserves. Twelve lode properties in and adjacent to the roadless area have occurrences of gold-rich zones with low to moderate resource potential. Seven lode and nine placer properties have low to high potential for gold resource, based on production records and assay values.

GEOLOGY

The Tuolumne River Roadless Area is located in the western Sierra Nevada, where a metamorphic belt flanks the west side of the Sierra Nevada batholith. The East belt, a mineralized zone that parallels the famed Mother Lode belt, crosses the roadless area. The roadless area contains upper Paleozoic metasedimentary rocks of the Calaveras Complex of Schweickert and others (1977), Mesozoic diorite and granitic intrusive rocks, numerous dikes and veins of probable Mesozoic age, and Tertiary volcanic rocks. The Calaveras Complex of Schweickert and others (1977) is divided into four units, a basal metavolcanic unit with associated argillite and slate, an argillite, a chert, and a quartzite. Fossil horn corals, tentatively identified as Caninia sp., Carboniferous and Permian in age, occur in a limestone bed in the argillite unit of the Calaveras Complex near the confluence of the Clavey and the Tuolumne River (Schweickert and others, 1977).

Studies by Schweickert (1981), Merguerian (1982), Sharp and others (1982), and Schweickert and Bogen (1983), have indicated, through structural analysis, correlation, and dating of orthogneisses in the quartzite unit of the Calaveras Complex of Schweickert and others (1977), that the quartzite unit may be early Paleozoic in age. This provides evidence that it may actually be the lowest unit of the Shoo Fly Complex, separated from the Calaveras Complex by the Calaveras-Shoo Fly thrust. Merguerian (1982) has mapped the Calaveras-Shoo Fly thrust through the roadless area, describing it as an east-dipping mylonitic thrust zone that extends for almost 110 mi in the western Sierra Nevada foothills. Geologic mapping by the USGS in the vicinity of the roadless area for this report did not reveal sufficient information for dating the quartzite unit or for including the Calaveras-Shoo Fly thrust on the geologic map.

GEOCHEMISTRY

A geochemical sampling of the Tuolumne River Roadless Area was completed by the U.S. Bureau of Mines during their 1975 appraisal for the Wild and Scenic Rivers Act. (A. M. Leszcykowski and E. L. McHugh, unpublished administrative report to the U. S. Forest Service). The results of this sampling were considered by Hyndman and others (1983)

Sediments were sampled in each of the significant tributaries of the Tuolumne River. Intermittent streams with no flowing water were, in most cases, not sampled. Sediment samples were taken from the main Tuolumne River, generally at intervals of less than 1 mile, for control purposes and to provide background elemental concentrations. The results of the geochemical study show small amounts of gold and silver in all samples. However, only one sample (S16), contained anomalous gold, and only four (S16, S18, S21, S26) contained anomalous silver. Lead was anomalous in one sample (S32), and zinc was anomalous in another (S36). Anomalous values for chromium and titanium were detected in four samples (S18, S20, S26, S27), and for zirconium in two samples (S19, S21).

GEOPHYSICS

Maps compiled from gravity and aeromagnetic surveys were used to aid geologic mapping and mineral appraisal of the Tuolumne River Roadless Area. Plouff (1982) established 18 gravity stations to supplement previous gravity observations in the area by Robbins and others (1976). An unpublished isostatic residual gravity map has one fairly well defined anomaly on an otherwise featureless map. The anomaly is a gravity low of low amplitude with an axis that extends eastward from Grapevine Point to Drew Meadow near the east edge of the map. The anomaly may reflect a northwestward subsurface extension of the diorite pluton exposed near the Lumsden Bridge.

The magnetic relief shown on an unpublished aeromagnetic map of the region is smaller than in most of the surrounding area. The overall low relief of the aeromagnetic map in this area indicates that rocks of low magnetization in the Calaveras Complex extend to depths that probably exceed 1 mi beneath the surface.

A few small highs on the aeromagnetic map reflect small underlying bodies with low to moderate magnetization. Narrow magnetic highs that extend nearly 2 mi southeast from the Kanaka mine (48) may reflect magnetite-bearing veins or dikes that follow a regional geologic trend parallel to the strike of the Sierra Nevada. A narrow magnetic high extends nearly 5 mi southeast from Grapevine Point.

MINES AND MINERALIZATION

Gold occurs in both lode and placer deposits within and near the Tuolumne River Roadless Area (Tables 1-4). The lode deposits occur as ribbon quartz veins and stringers, with disseminated pyrite, within shear zones in the metasedimentary rocks of the Calaveras Complex and in plutonic rocks. Lead, silver, copper, and zinc minerals are occasionally associated with higher concentrations of gold.

Three vein systems in the roadless area contain most of the lode-gold deposits. The vein systems are the northwest-trending East belt, and the east-trending Mary Ellen and Florida vein systems. A subsidiary linear zone, the Mohican cross-vein system, intersects the two east-trending vein systems.

Mineralization in the roadless area may be related to the intrusion of the plutonic rocks. The mineralized quartz veins are more extensive in the Calaveras Complex than in the plutonic rocks. Many of the mines and prospects in the western part of the roadless area are associated with limestone bodies.

Placer deposits occur in Holocene gravels in the Tuolumne River channel and in associated gravel bars, and in Tertiary gravels on the canyon slopes and canyon rim adjacent to the south boundary of the roadless area, where they are partially covered by lava flows. The placer gold is derived in part from gold-bearing veins of the vein systems, and in part from older, reworked placer deposits. Gold concentrations are generally highest in the gravels adjacent to the bedrock and in the active Tuolumne River channel in the western part of the roadless area.

Mining has occurred in the area since 1850, and more than 1500 lode and 300 placer claims have been recorded in the Tuolumne River Roadless Area since the 1870's. Approximately 60,530 oz of gold has been produced from lode mines in and adjacent to the roadless area. Most of these mines are in the western half of the roadless area. Placer production from Holocene gravel within the roadless area has been 1,700 oz gold. Tertiary placer deposits yielded 51,300 oz gold from four placer mines adjacent to the roadless area. Total placer production from Holocene gravel in the Groveland-Big Oak Flat area has been 1.2 million oz of gold.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

The geologic and mineral surveys indicate that identified resources and high potential for additional resources exist for gold in the Tuolumne River Roadless Area. To be classified as a resource by the USBM, the value of the deposit must be equal to or greater than 20 percent of the anticipated production cost. The locations of the anomalous geochemical samples do not coincide with areas of mineral resource potential indicated by the geology and mineral occurrences; they are probably due to erosion of Tertiary auriferous gravels on the canyon rim.

Two placer prospects and one lode mine in, and one placer and three lode mines adjacent to the roadless area have identified subeconomic resources for gold (table 1). Eight lode mines and one lode prospect in, and two lode mines and one lode prospect adjacent to the roadless area have low to moderate potential for gold, based on the occurrences of gold-rich zones or shoots. Most of these deposits are of low tonnage, but if some of them are considered together as a unit, they become an identified resource (table 2). One placer prospect and one placer mine in, and one placer mine adjacent to the roadless area have high resource potential; one placer mine in and one lode and two placer mines adjacent to the roadless area have moderate resource potential; and two lode mines and four lode prospects in, and three placer mines adjacent to the roadless area have low resource potential; all for gold on the basis of production records and assay values (table 3).

There is an estimated 77,000 yd3 of Holocene auriferous gravel in the roadless area in the Tuolumne River channel and associated bars, primarily the South Fork bar, plus a small amount of Tertiary auriferous gravel on the canyon slopes and 40 million yd 3 of Tertiary gravels on the canyon rim adjacent to the south boundary of the roadless area covered in part by lava flows. Mining of the Tertiary and Holocene gravels would be limited to small-scale mining operations due to the steep gradient and narrow width of the canyon, preventing accumulation of large deposits of gravel, and to the restrictions on hydraulic mining. Small-scale suction dredging and recreational panning, however, could be expected to occur on a regular basis.

The marble, limestone, and dolomite deposits adjacent to the Tuolumne River Roadless Area at the Jacobsen (Sudall) Ranch (4) and Marlow (1) prospects and within the roadless area could be used for Portland cement, chemical uses, or for lime in gold milling operations. The Jacobsen (Sudall) Ranch marble prospect contains about 11 million tons of marginal reserves of marble.

There are no indications for the existence of coal, oil, gas, or geothermal resources in the roadless area.

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Table 1.—Properties with identified mineral resources in the Tuolumne River Roadless Area and vicinity

[Underlined names refer to properties inside the area]

Map no.	Name	Quantity	Classification	Grade	Commodity
4	Jacobsen (Sudall) Ranch prospect	11 million tons	Marginal reserves	Suitable for construction and chemical uses	Marble
5	Sunnyside mine	2,100 tons 1,600 tons	Subeconomic resources	0.79 oz per ton 0.13 oz per ton	Lode gold
28	Eagle Bluff mine	2,500 tons 200 tons	-	0.37 oz per ton 0.47 oz per ton	-
42	Indian Creek prospect	9,000 yd3	-	0.002 troy oz per yd 3	Placer gold
44	Hull mine	2,700 tons 350 tons	-	0.57 oz per ton 0.12 oz per ton	Lode gold
48	Kanaka mine	7,000 tons 13,000 tons	-	0.19 oz per ton 0.05 oz per ton	-
52	Kings Road mine	13,000 yd3	-	0.0022 troy oz per yd3	Placer gold
55	Bossy Bar prospect	6,500 yd3	-	0.02 troy oz per yd3	-

Table 2.—Lode mines and prospects with resource potential for gold, based on the occurrences of gold-bearing shoots/in the Tuolumne River Roadless Area and vicinity

[Underlined names refer to properties inside the area]

Map no.	Name	Tonnage	Grade (oz of gold per ton)	Resource potential
6	Balmoral prospect	150	0.10	low
7	Rough and Ready prospect	120	0.09	low
9	Ultima Chansa mine	390	0.26	low
18	San Francisco mine	18	0.39	moderate
19	Mohican mine	770	0.19	moderate
21	Mary Ellen mine	2,200 550	0.09 0.97	moderate
31	Winslow mine	300	0.50	moderate
32	Ellen Winton mine	50	0.13	moderate
33	River Bend mine	650	0.23	moderate
36	Chaparral mine	160	0.63	low
38	Modoc mine	660	0.97	moderate
40	Duleek mine	300	0.11	low

Table 3.—Lode and placer mines and prospects in the Tuolumne River Roadless Area and vicinity with resource potential for gold based on production records and assay values

[Underlined names refer to properties inside the roadless area]

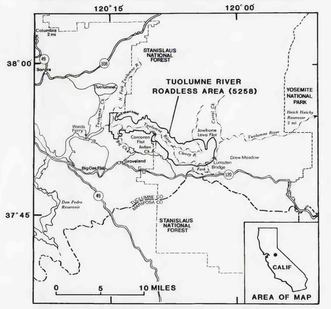
Map no.	Name	Deposit type	Grade (oz gold per ton)	Resource potential
2	Marlow placer mine	placer	not available	moderate
8	Gave Diggins mine	placer	not available	low
21	Mary Ellen mine	placer	not available	moderate
22	Mamcot prospect	lode	0.005-1.072	low
24	Alpine mine	lode	0.068-0.284	low
29	Big Creek mine	placer	0.0012-0.071	high
34	Buchanan mine	lode	not examined	moderate
37	Garfield-Virginia prospect	lode	0.010-0.092	low
39	O.K. prospect	lode	0.020-0.140; 1.0 oz silver per ton	low
41	Goldship-Mayflower mine	placer	not available	low
43	Garner mine	lode	0.010-0.159	low
46	Grapevine prospect	lode	0.024-0.106	low
47	Golden Grain mine	placer	0.001-0.033	moderate
51	Clavey Falls prospect	placer	0.001-0.075	high
54	Bonanza mine	placer	0.007	low
57	Little Gap mine	placer	not available	high

Table 4.—List of mines and prospects in and adjacent to the Tuolumne River Roadless Area, Tuolumne County, California

1—Marlow dolomite deposit
2—Marlow placer mine
3—Pine Bar prospect (patented)
4—Jacobsen (Sudall) Ranch prospect
5—Sunnyside mine
6—Balmoral prospect
7—Rough and Ready prospect
8—Gave Diggins mine (patented)
9—Ultima Chansa mine
10—Florida prospect
11—Josiah prospect (patented)
12—Agua Regia prospect
13—Rotten Hull mine
14—Rooton mine (formerly patented)
15—Bailey prospect
16—Telegraph mine
17—Apperson prospect
18—San Francisco mine
19—Mohican mine (patented)
20—Golden Slipper prospect
21—Mary Ellen mine (lode-patented and placer)
22—Mamcot prospect
23—Broken Pick prospect
24—Alpine mine
25—Old 49er prospect
26—Hamel prospect
27—La Preciosa mine (patented)
28—Eagle Bluff mine
29—Big Creek mine
30—Del Monte mine
31—Winslow mine
32—Ellen Winton mine
33—River Bend mine
34—Buchanan mine (patented)
35—Elk and Hedge prospect (patented)
36—Chaparral mine (patented)
37—Garfield-Virginia prospect (patented)
38—Modoc mine
39—O.K. prospect
40—Duleek mine (patented)
41—Goldship-Mayflower mine (patented)
42—Indian Creek Bar prospect
43—Garner mine
44—Hull mine (patented)
45—Corcoran Flat mine
46—Grapevine prospect
47—Golden Grain mine
48—Kanaka mine
49—Last Pon mine
50—Duplex prospect
51—Clavey Falls prospect
52—Kings Road mine
53—Gold Queen mine
54—Bonanza mine
55—Bossy Bar prospect
56—Adit Spring prospect
57—Little Gap mine
58—Poverty Ridge prospect
59—Sunderland's Chute prospect
60—Rentals prospect
61—Harvest Hole prospect
62—South Fork prospect
63—Lumsden Bridge prospect
64—Hull Meadows prospect

Mines to the north and west of the Tuolumne River Roadless Area (not examined for this report; resources or potential not estimated)

A—Eureka
B—New Albany
C—Grizzly
D—Seminole
E—Wescoter
F—Providence
G—New Year
H—Starr King
I—Mckinley
J—Empire
K—Goldvein
L—Spring Gulch
M—Hard Tack
N—Hunter
O—Pree Lance



INDEX MAP SHOWING LOCATION OF THE TUOLUMNE RIVER ROADLESS AREA, WESTERN SIERRA NEVADA, CALIFORNIA