Studies Related to Wilderness— Primitive Areas, 1967-1969

GEOLOGICAL SURVEY BULLETIN 1261

This volume was published as separate chapters A-G

UNITED STATES DEPARTMENT OF THE INTERIOR

WALTER J. HICKEL, *Secretary*

GEOLOGICAL SURVEY

William T. Pecora, *Director*

Library of Congress catalog-card No. GS 75-605185

CONTENTS

[Letters designate the separately published chapters]

U.S. GOVERNMENT PRINTING OFFICE: 1970 O—368-456

Mineral Resources of the Desolation Primitive Area of the Sierra Nevada, California

By F. C. W. DODGE, U.S. GEOLOGICAL SURVEY, *and* P. V. FILLO, U.S. BUREAU OF MINES

STUDIES RELATED TO WILDERNESS—PRIMITIVE AREAS

GEOLOGICAL SURVEY BULLETIN 1261-A

Evaluation of the mineral potential of a national primitive area

---

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1967

UNITED STATES DEPARTMENT OF THE INTERIOR

STEWART L. UDALL, *Secretary*

GEOLOGICAL SURVEY

William T. Pecora, *Director*

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

STUDIES RELATED TO WILDERNESS
PRIMITIVE AREAS

Pursuant to the Wilderness Act (Public Law 88-577, Sept. 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, but the act provided that each primitive area should be studied for its suitability for incorporation into the Wilderness System. The mineral surveys constitute one aspect of the suitability studies. This bulletin reports the results of a mineral survey in the Desolation Valley primitive area, California. The area discussed in the report corresponds to the area under consideration for wilderness status. It is not identical with the original Desolation Valley Primitive Area as defined because modifications of the boundary have been proposed for the area to be considered for wilderness status. The area that was studied is referred to in this report as the Desolation Valley primitive area.

This bulletin is one of a series of similar reports on primitive areas.

CONTENTS

ILLUSTRATIONS

TABLES

MINERAL RESOURCES OF THE DESOLATION VALLEY PRIMITIVE AREA OF THE SIERRA NEVADA, CALIFORNIA

By F. C. W. Dodge, U.S. Geological Survey, and P. V. Fillo
U.S. Bureau of Mines

SUMMARY

The Desolation Valley primitive area, California, includes about 100 square miles of glaciated terrain extending along the main crestal area of the Sierra Nevada southwest of Lake Tahoe. Intrusive bodies of the Sierra Nevada batholith and remnants of metamorphosed roof rocks are well exposed within the primitive area, although locally, these rocks are covered by deposits of moraine, talus, or stream sediments.

A small area half a mile south of Gilmore Lake in the NE¼ sec. 17, T. 12 N., R. 17 E., contains significant amounts of gold and must be regarded as having economic potential for gold. In this mineralized area, hornfelsic metavolcanic rocks contain sulfide minerals and gold in veinlets occupying small fractures and in disseminated grains. Of 48 samples taken in an area of about 2,000 by 150 feet, 15 contained 1 ppm or more in gold—the richest containing 46 ppm or about $50.00 per ton of rock. Insofar as known from surface outcrops, the deposit is too low in grade, the gold is too erratically distributed, and the area of occurrence too difficult of access for this deposit to be commercially exploitable; however, the deposit is promising enough in mineral character and dimensions to warrant further exploration.

In other geologic environments elsewhere in the primitive area, no evidence of economic mineral deposits was found. Tactite bodies, which are important hosts for tungsten minerals in other parts of the Sierra Nevada, are small and do not contain important concentrations of valuable minerals. Pegmatites and massive quartz veins are exceedingly rare, and those observed are not mineralized. Granitic rocks that are stained with iron oxide were found to have no enrichment of base or precious metals appreciably greater than their unstained counterparts.

No buried placer deposits are believed to occur within the area. Glacial erosion has stripped any remnants of Tertiary stream channels that formerly may have been present. Panned concentrates of Recent stream sediments do not contain concentrations of valuable metallic minerals or metals.

There is no record of mineral production from the area, and no mineral commodities that can be mined economically at present (1966) are known to occur within the boundaries.

INTRODUCTION

LOCATION AND GENERAL FEATURES

The Desolation Valley primitive area is in El Dorado County, Calif., near the southwestern shore of Lake Tahoe. The area is irregularly shaped and covers 101 square miles. It is elongate parallel to the crest of the Sierra Nevada and is 15 miles long and 6–8 miles wide. The western part of the U.S. Geological Survey Fallen Leaf Lake 15-minute topographic quadrangle covers all the area, except for small parts west of long 120°15′ and north of lat 30°00′, which are in the Robbs Peak and Tahoe 15-minute quadrangles, respectively.

Topographically, the area is dominated on the east by peaks and subsidiary spurs of the main crest of the Sierra Nevada and on the west by those of the crest of the Crystal Range. These two parallel ranges are separated in the northern two-thirds of the area by Rockbound Valley, a U-shaped glacial valley (fig. 1), and in the south third of the area by Desolation Valley, a large shallow cirque. Altitudes range from 9,983 feet at the summit of Pyramid Peak on the crest of the Crystal Range to about 6,400 feet at the point where the southern boundary of the area intersects Pyramid Creek south of Desolation Valley. The average altitude is slightly more than 8,000 feet.

Surface features of the area have been largely shaped by Pleistocene alpine glaciation. Lakes fill many of the numerous cirques that dot the area; however, the two largest lakes—Lake Aloha and Rubicon Reservoir—are artificial. Glacial erosion has stripped the soil, exposing barren rock in the southwestern half of the area. Spotty forest, consisting principally of lodgepole pine, but including other species of conifers, covers the northeastern region.

The area is accessible by foot trails that extends from U.S. Highway 50 to the south of the area, from California State Highway 89 to the east, and from other trails that extend from secondary roads leading from these two major highways. Only U.S. Highway 50 is kept clear of snow in winter months. The western and northern boundaries of the area may be reached by jeep and foot trails leading from unimproved roads. The nearest rail shipping points are at Truckee, 29 miles northeast of the area, and at Camino, 45 miles west.

PREVIOUS STUDIES

The Desolation Valley area has been studied by several geologists over a period of many years. Two of Lindgren's (1896, 1897) folios on California's gold belt cover the Desolation Valley area at a scale of 1:125,000. Loomis (1964) has remapped and redescribed the geology of the Fallen Leaf Lake quadrangle. Other geologic reports in-

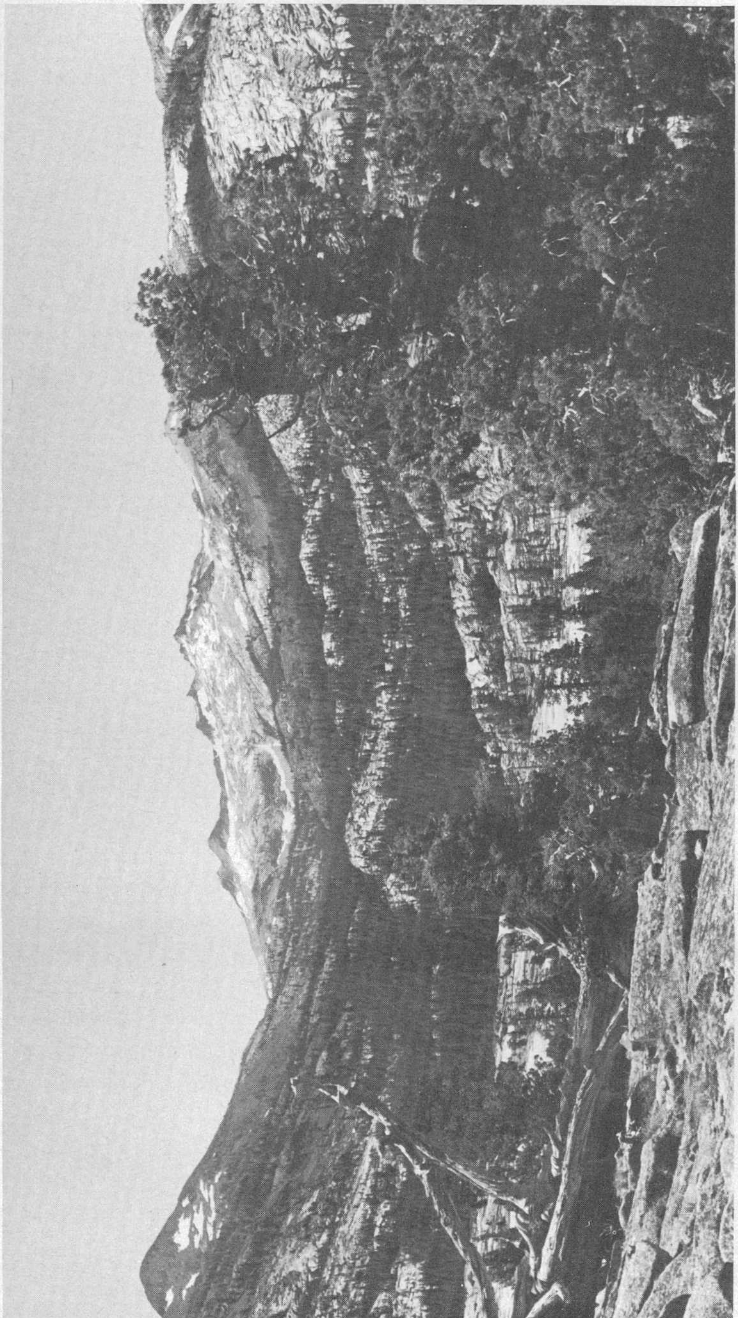


FIGURE 1.—Rockbound Valley, looking south from Middle Mountain. Peaks of the Crystal Range in center; rounded peak on left is Jacks Peak on main Sierra Nevada crest. Dark rocks of Mount Tallac pendant in middleground; light-colored granitic rocks elsewhere.

257-200 O—67——2

clude statistical evaluations of specific gravity and mineral variations of a stock in the eastern part of the area (Peikert, 1962a, b), a study of noritic bodies (Loomis, 1963) also in the eastern part of the area, and a study of contact reactions in metamorphic rocks (Loomis, 1966). The geologic features of the area have also been the subject of three theses (Loomis, 1960; McAllister, 1936; Peikert, 1958).

PRESENT INVESTIGATION

The U.S. Bureau of mines conducted a record search in the El Dorado County recorder's office on claims located within the Desolation Valley primitive area boundaries. The records showed that 3 groups of unpatented claims—8 lode claims and 14 placer claims—were located and that all were subsequently abandoned.

A further study of the Desolation Valley primitive area was made during parts of July, August, and September, 1966, by the U.S. Geological Survey; this study consisted of a reconnaissance of the geology of the area and field checking existing geologic maps. Following this work, a generalized geologic map was compiled at a scale of 1:62,500 (pl. 1), and areas considered favorable for mineral deposits were carefully reexamined. Two groups of mining claims in the area were examined, but a third group of claims was not found after 2 days of field searching because of an inadequate location description. All foot traverses made during fieldwork are shown in figure 2.

Many samples of fresh, altered, and some mineralized rocks were collected for laboratory study. Samples of alluvium from the major streams and several of their tributaries were panned to obtain heavy mineral concentrates. Sample localities are shown in figure 3. Semiquantitative spectrographic analyses [1] of rock samples and panned concentrates and atomic absorption analyses of rock samples suspected of possibly containing gold were made at the U.S. Geological Survey laboratories in Denver, Colo., and at Menlo Park, Calif. Additional laboratory study included examination of thin sections of rock specimens under the petrographic microscope, X-ray identification of some mineral constituents, and modal analyses of sawed and stained plutonic rocks.

Several colleagues of the Geological Survey aided in the study of the Desolation Valley area. N. K. Huber helped with preparatory work before the field investigation; the Josie claims were mapped in the

[1] Semiquantitative spectrographic results are reported to the nearest number in the series 10, 7, 5, 3, 2, 1.5, 1, etc., which represent approximate midpoints of group data on a geometric scale. The assigned group for semiquantitative results will include the quantitative value about 30 percent of the time.

company of J. P. Albers and W. A. Duffield; and S. D. Ludington assisted in much of the fieldwork and preliminary laboratory investigations.

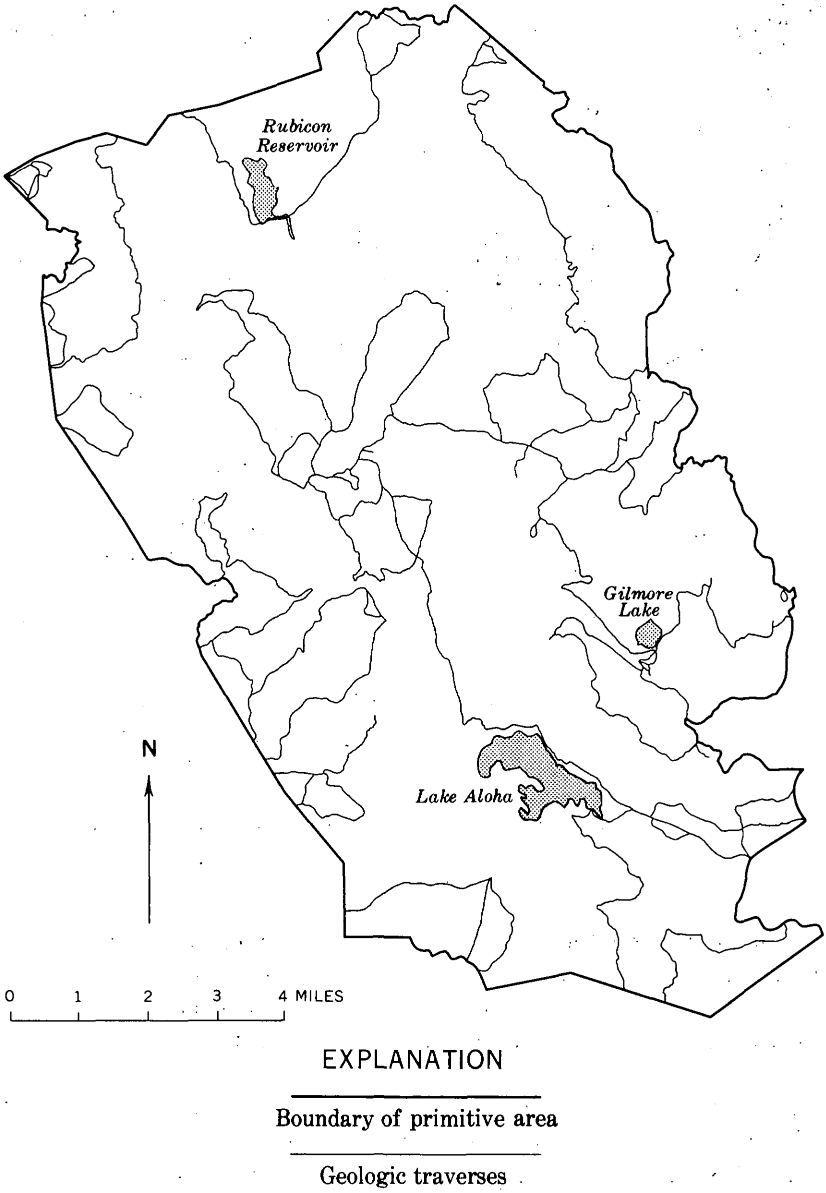


FIGURE 2.—Geologic traverses within the Desolation Valley primitive area.

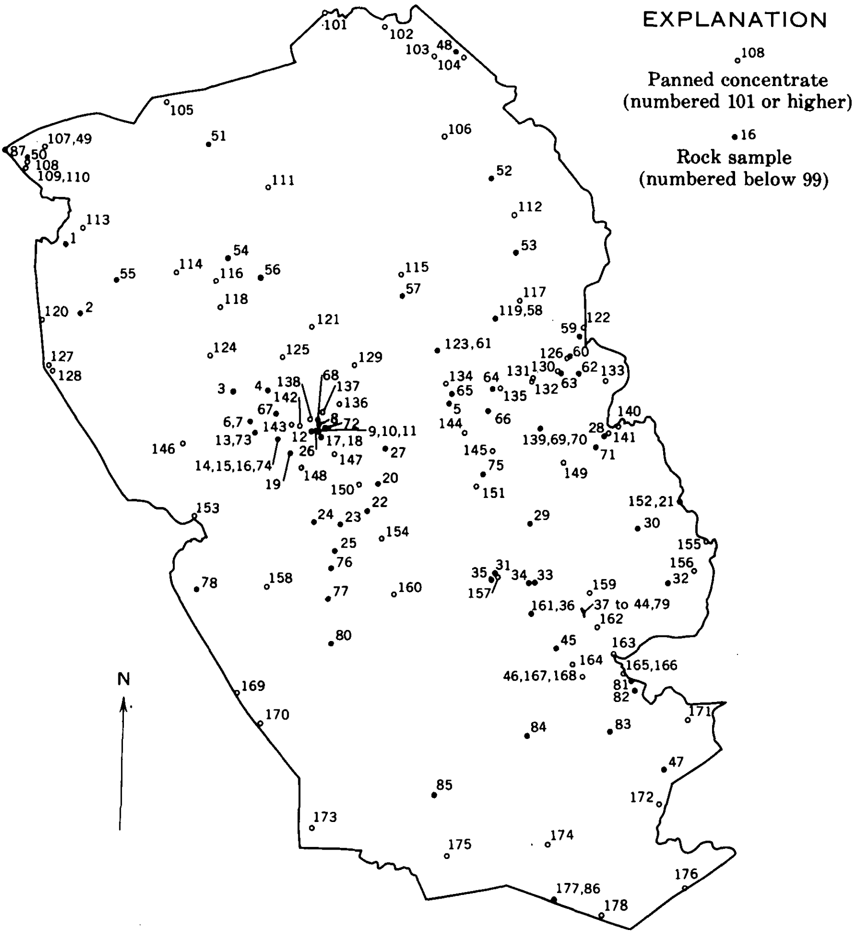


FIGURE 3.—Locations of analyzed samples of rocks and alluvium.

GEOLOGY

The Desolation Valley primitive area is underlain by igneous rocks of the Sierra Nevada batholith, remnants of metamorphic rocks of several types, and younger surficial deposits. The oldest rocks consist of a thick sequence of metamorphosed sedimentary and volcanic deposits, at least some of which were deposited in the Early Jurassic. This entire sequence was buried, folded, and intruded by granitic plutonic bodies of the composite Sierra Nevada batholith before the Late Cretaceous. Prolonged erosion since intrusive emplacement has unroofed the batholith, and repeated uplift has elevated the mountains to their present heights. During the late Cenozoic, lavas were extruded over an extensive part of the batholith; however, only two small patches of the resulting volcanic rocks remain within the primitive area. The youngest geologic units within the area are Quaternary moraines, lacustrine deposits, talus, stream gravels, and soils, all in scattered small deposits.

METAMORPHIC ROCKS

The prebatholithic metamorphic rocks occur in the east-trending Mount Tallac pendant in the east-central part of the primitive area, and other smaller additional bodies of metamorphic rocks, locally approaching diorite in composition and texture, are concentrated in the western part of the area. Two groups of metamorphic rocks have been recognized, a metasedimentary sequence and a conformably overlying metavolcanic sequence. Rocks of the western half of the main pendant and of nearby large inclusions are almost entirely metasedimentary, whereas those of the eastern half are dominantly metavolcanic. Except for the delineation of tactite bodies within the metasedimentary rocks (pl. 1), no attempt has been made to subdivide the metasedimentary and metavolcanic units. Also, because of their intimate relation with the metasedimentary rocks, poor exposure, and rather small areal extent, numerous mafic bodies in the western part of the pendant have not been shown separately on the geologic map.

The facies relations of the metamorphic rocks are similar to those generally observed in pendants elsewhere in the Sierra Nevada batholith (Williams and others, 1955).

METASEDIMENTARY ROCKS

Fine-grained calc- and quartzo-feldspathic hornfels derived from argillaceous limestone and marly shales are the most abundant types of metasedimentary rock. Weathered outcrops of these hornfels generally are brown, but fresh surfaces range from bluish white to black. The calc-hornfels are massive light-colored rocks consisting chiefly of quartz, plagioclase, and diopside, but also containing subordinate calcite, epidote, grossularite garnet, idocrase, actinolite, scapolite, sphene, wollastonite, and opaque minerals. In contrast, the quartzo-feldspathic hornfels generally are finely laminar and dark, consisting principally of quartz, plagioclase, biotite, and actinolite in zones of lower grade metamorphism and also of hornblende in zones of higher grade metamorphism. As the amount of feldspar and mafic minerals decrease, the hornfels grades into quartzite. Locally, light-colored quartz-rich beds are interlayered with darker mafic hornfels, giving these rocks a strikingly banded appearance. Marble is rare except at one locality on the west slope of Rockbound Valley; elsewhere, it occurs only in small pods in tactite zones.

Tactite crops out within the Mount Tallac pendant in a few irregularly shaped masses that cannot be related to any apparent structural feature. Three small lenses of tactite, each having an outcrop area of no more than 20 square feet, are exposed adjacent to the main mass of granitic rock 1 mile east of Lake Schmidell. A somewhat larger mass of tactite, about 500 square feet in surface area, crops out about one-third of a mile southeast of Lake Schmidell. Here, the tactite is intimately associated with a hornblende dacite dike. Another tactite zone about 2 feet wide borders a mafic dike in a gully half a mile northeast of Lake Lois, and a few discontinuous tactite layers 3–4 inches thick occur within a large inclusion of hornfels above Lake Schmidell (fig. 4). These layers contain coarse-grained diopside, epidote, grossularite garnet, locally idocrase, and lesser amounts of quartz, plagioclase, calcite, and opaque minerals.

METAVOLCANIC ROCKS

The metavolcanic rocks in the eastern part of the pendant are principally dark quartzo-feldspathic hornfels. Relict textural features typical of volcanic rocks are present, but because of extensive recrystallization, the composition of the original rocks is uncertain. However, the presence of quartz and biotite accompanying the other minerals of the hornfels—plagioclase, hornblende or tremolite, minor amounts of epidote and opaque minerals, and, in pneumatolized rocks, tourmaline—suggests that the parent rocks were probably andesites or dacites rather than basalts.

Most of the metavolcanic hornfels are believed to have been derived from pryoclastic rocks. A broad area just east of the metavolcanic-metasedimentary contact is underlain by metavolcanic breccia. The metamorphism of this breccia generally produced quartzo-feldspathic hornfels, but locally, because of the abundance of included calcareous rock fragments, cale-hornfels was produced. Sulfide minerals are a trace, but conspicuous, constituent of the breccia.

An Early Jurassic ammonite was reported from metavolcanic rocks of the roof pendant (Loomis, 1964), and the rocks were prĕvisionally correlated with Jurassic rocks north of the Desolation Valley area (Lindgren, 1896). However, as only one definitive fossil has been found from the metamorphic sequence, and its original location is uncertain, the metamorphic rocks are herein simply considered Mesozoic.

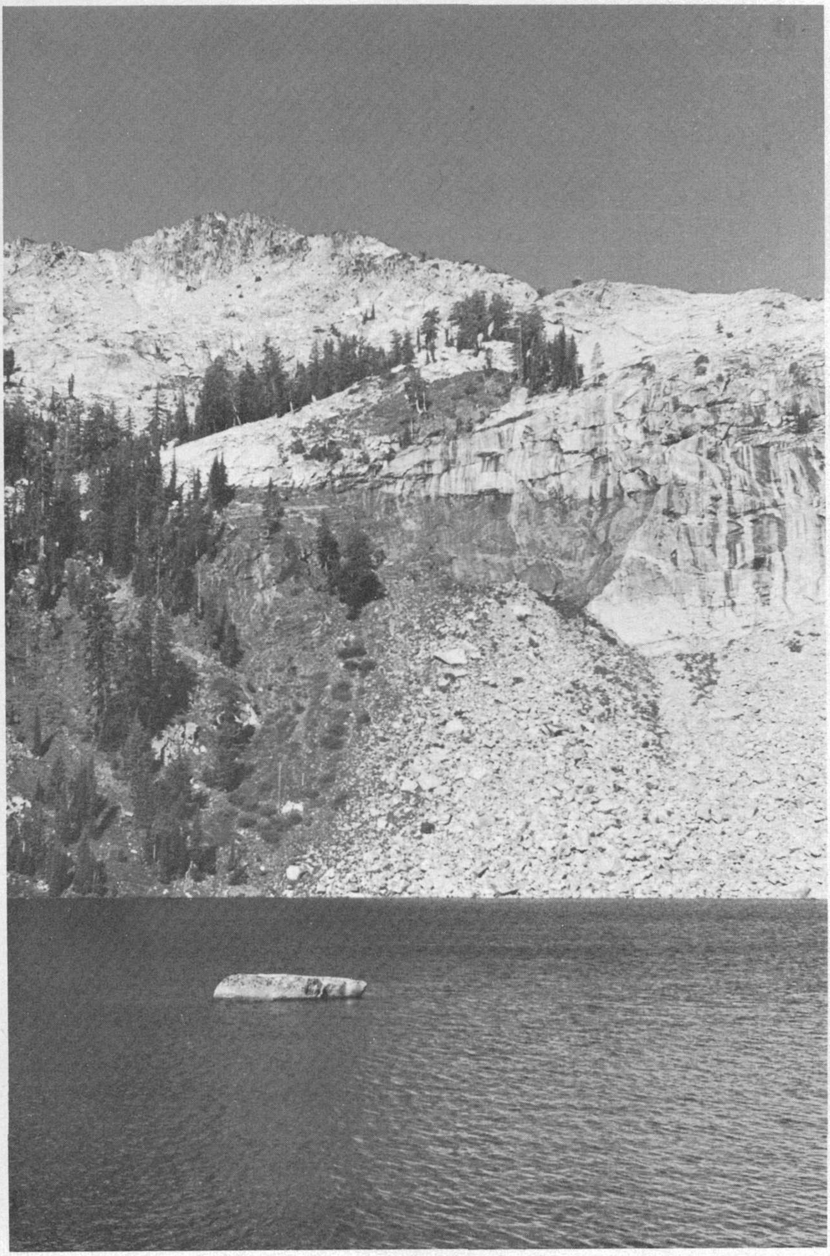


FIGURE 4.—Contact between granitic rocks and metamorphic rocks of the western extremity of the Mount Tallac pendant. Small amounts of tactite are present in the inclusion above the main mass of metamorphics. Red Peak in the background.

PLUTONIC ROCKS

DIORITIC ROCKS

Several masses of dioritic rocks are exposed in the southwestern and northeastern parts of the primitive area. Small pods and wisps, not shown on the map (pl. 1), are also present in the western part of the pendant. In some places a complete transition from dark igneous or igneous-appearing rocks to metamorphic rocks can be noted; consequently, distinction between the two rock types is locally arbitrary. Although the contacts between granitic and dioritic rocks are also generally sharp, the age relations are not consistent throughout the area. Some dioritic material was clearly derived from metamorphic rock, but its heterogeous nature suggests the possibility of diverse origins. Probably some has also crystallized directly from magma that was injected into preexisting rocks.

Compositionally, the dioritic rocks range from quartz diorite to hornblende gabbro, hornblende-rich quartz diorite being most abundant. Hornblende is common to all the mafic rocks, and biotite is also widespread; quantities of augite, quartz, magnetite, and potassium feldspar may or may not be present. Textures are extremely diverse; commonly, the dioritic rocks have no apparent foliation, but locally, particularly in the pendant, they are highly sheared.

NORITIC ROCKS

A small mass of noritic rocks near the east side of the area was studied and described in detail by Loomis (1963) and named the norite of the Eagle Lake sequence. These rocks are fine- to medium-grained leucocratic norites containing plagioclase, hypersthene, hornblende, magnetite, and minor amounts of quartz, calcite, augite, biotite, and apatite. Compositional banding is a conspicuous feature of the unit.

GRANITIC ROCKS

Three-quarters of the primitive area is underlain by quartz-bearing plutonic rocks of granitic composition. At least eight discrete granitic units are recognizable in the field, but in this report no distinction between the individual masses has been made on the geologic map (pl. 1). Contacts betwen separate intrusive bodies and between intrusive and metamorphic rocks are generally steep dipping; foliations within the bodies, defined by planar orientation of mafic inclusions and minerals, also are generally parallel to the contacts.

Compositionally, granodiorite is most prevalent, but the intrusive masses range from quartz monzonite to quartz diorite. Quartz monzonite underlies much of the southwestern part of the Crystal Range. Quartz diorite crops out in some areas east of the main Sierran crest between Heather Lake and Phipps Pass. Quartz, plagioclase, and biotite are ubiquitous major constituents of the granitic rocks. Potassium feldspar occurs in all but the most mafic quartz diorites. Hornblende is present in most granodiorites and in quartz diorites. Magnetite, apatite, zircon, sphene, and allanite are common accessory minerals. Sericite, chlorite, epidote, and limonite are alteration products and are locally present in trace amounts.

Most of the granitic rocks in the northern third of the primitive area are characterized texturally by coarse-grained euhedral to subhedral feldspar phenocrysts embedded in a medium-grained equigranular groundmass. Medium- to coarse-grained equigranular or seriate granular textures are common in the granitic rocks throughout the rest of the area.

Large areas of granitic rocks in the southern part of the Crystal Range are stained reddish brown. Although the staining is unrelated to a specific granitic mass, it is generally restricted to quartz monzonites and felsic granodiorites that are devoid of hornblende. No differences between stained and unstained rocks from the same mass could be seen in thin section, but cubes of martite pseudomorphous after pyrite were noted in a few hand specimens. Presumably, the staining is due to fine iron oxide films along grain boundaries and may be the result of oxidation of disseminated pyrite.

DIKE ROCKS

Dikes that are a fraction of an inch to a few feet wide and as much as several hundred feet long cut the metamorphic and plutonic rocks of the primitive area. In general, they are of little quantitative importance and are not shown on the geologic map. Steep-dipping dark basaltic dikes cut the granitic rocks at a few places, and hypabyssal dikes ranging in composition from basalt to rhyodacite cut metasedimentary rocks in the northwestern part of the pendant and are associated with some tactites. Dikes of highly siliceous material are rare; where present in some of the granitic masses, aplites predominate, but commonly both aplitic and pegmatitic textures are present in the same dike.

VOLCANIC ROCKS

Two small areas along the western boundary of the primitive area are covered by a veneer of dark porphyritic olivine basalt. Well-developed columnar jointing is a conspicuous feature of the basalt that caps Brown Mountain; basalt near Forni Lake occurs as poorly exposed rubble. Granitic glacial erratics rest unconformably on the basalt at Brown Mountain, suggesting a Tertiary age for the volcanic rocks.

UNCONSOLIDATED DEPOSITS

Unconsolidated deposits consisting of glacial moraine, stream gravels, lacustrine deposits, soils, and talus cover small parts of the primitive area; of these deposits, only the glacial moraine is shown on the geologic map. Glacial erratics are widely distributed. The unconsolidated deposits were derived entirely from older materials presently exposed within the area.

STRUCTURE

Two major folds within the Tallac pendant—a syncline near the summit of Mount Tallac in metavolcanic rocks and an anticline west of Rockbound Valley in metasedimentary rocks—were mapped by Loomis (1964). He states that the folds have wave lengths from 6 to 7 miles, amplitudes of about 3 miles, nearly vertical axial planes, and fold axes that trend N. 25° W. and plunge 15° N. Repeated reversals in dip, noted particularly in metasedimentary strata exposed on the west side of Rockbound Valley, indicate that steep tight folds may be an important structural element; whereas elsewhere, as in outcrops on the floor of Rockbound Valley, well-defined strata show no evidence of folding. Original bedding is rarely discernible in exposures of metavolcanic rock.

Granitic masses within the primitive area are a part of the larger mosaic of instrusives of the Sierra Nevada batholith, and their structural features are merely reflections of major trends of the composite batholith. In general, the igneous bodies are elongated northwestward and have steep-dipping contacts. Planar structures within the bodies, defined by preferentially oriented mineral grains and mafic inclusions, tend to follow the contacts except where they are cut by later intrusions.

Convincing evidence of extensive faulting is absent within the area, except for minor displacements of no more than a few feet along joint surfaces. This is in disagreement with the findings of Loomis (1964) who mapped several faults, but reaffirms observations made by Lindgren (1896) who states that indications of extensive faulting are present only at one place outside the primitive area.

Joints are prominently exposed in Desolation Valley and are conspicuous in granite masses elsewhere in the primitive area. Steep-dipping east-northeast-trending joints are most consistently developed, but at least two other somewhat variable-trending sets were recognized. Rarely, the joint surfaces are coated with hydrous mafic minerals, particularly chlorite and epidote.

MINERAL RESOURCES AND ECONOMIC APPRAISAL

MINES AND PROSPECTS

A small gold mine, the Noonchester mine, 3 miles north of the area, represents the only evidence of mining activity within several miles of the primitive area. The mine, which has no recorded commercial production, is in a mineralized zone in calcareous metasedimentary rocks which do not extend into the primitive area.

A search by the U.S. Bureau of Mines has revealed that only three groups of claims, all now abandoned, have been located within the Desolation Valley primitive area since 1910. Two of these groups were examined during this study. The third group, reportedly consisting of six lode claims, was located in 1935 on the east side of Mount Tallac. These claims could not be found from the original location description after 2 days of searching in the field.

It is reasonable to assume that the area was thoroughly prospected after the midnineteenth century discoveries of the Mother Lode to the west and Comstock Lode to the east; however, the early work of Lindgren (1896, 1897) indicates that nothing of significance had been found within the area before the mid-1890's.

No mineral production has been recorded from any claims in the area, as indicated by a search of Federal and county records by the U.S. Bureau of Mines.

PLACER DEPOSITS

Because of the sparseness of Cenozoic volcanic rocks, no buried placers of the type found in the Mother Lode district (Lindgren, 1911) are believed to occur in the primitive area. Pleistocene glacial erosion has stripped vestiges of Tertiary channel deposits that also may have existed; consequently, placer deposits can be expected to be confined to localities of Recent stream and river deposition.

An exceedingly small amount of debris has been deposited by the fast-rushing present-day streams of the area. River gravels occur in small patches only on the floor of Rockbound Valley and in the channel of the Rubicon River. Stream deposits were panned at numerous localities, primarily to help ascertain whether deposits of metallic minerals were present in the drainage areas. The panned concentrates, however, were found to be composed only of common heavy rock-forming minerals or lithic fragments. Spectrographic analyses of these concentrates did not indicate economically significant concentrates of metallic elements (table 1.) For purposes of comparison, spectrographic analyses of 21 hornblendes and 10 magnetites separated from granitic rocks of the batholith south of the primitive

TABLE 1.—*Analytical data of*

[Analysts: Harriet Nieman, Chris Heropoulos, E. L. Mosier, K. C. Watts, and J. M. Nishi. Atomic absor

Semiquantitative spectrographic analyses (ppm)

[Au determined by atomic absorption. Sb <100, W <50]

Sample	Au	Ti	Zn	Mn	V	La	Ni	Cu	Pb	Y	Mo	Sn	Co
					Metasedimentary rocks								
1	--	2,000	<200	700	50	30	15	10	20	10	<2	<20	7
2	--	5,000	<200	200	20	50	10	5	<10	30	<2	<20	<5
3	--	3,000	500	200	700	30	70	70	<10	30	30	<20	10
4	--	2,000	200	500	100	20	20	5	<10	20	<2	<20	5
5	<0.1	2,000	<200	200	150	<20	20	20	<10	20	3	<20	10
6	--	2,000	<200	1,000	300	<20	30	30	<10	10	<2	<20	10
7	--	1,000	1,000	1,500	300	50	30	30	150	20	<2	<20	10
8	--	2,000	200	700	300	<20	50	10	<10	10	<2	<20	30
9	--	2,000	200	1,000	150	<20	20	15	<10	20	<2	<20	7
10	--	2,000	<200	1,000	200	<20	30	100	<10	20	15	<20	7
11	--	2,000	<200	700	300	<20	50	10	<10	20	10	<20	5
12[1]	--	2,000	<200	300	100	<20	50	70	<10	20	2	<20	10
13	--	3,000	200	700	1,000	<20	50	70	<10	20	50	<20	10
14	--	2,000	<200	1,000	150	<20	10	5	<10	30	<2	30	<5
15	--	5,000	500	700	300	<20	20	5	<10	50	<2	20	10
16	--	1,500	<200	500	100	<20	10	15	<10	20	<2	20	10
17	--	2,000	200	700	70	30	7	5	15	30	<2	<20	<5
18	--	1,500	<200	200	200	<20	20	10	<10	15	3	<20	<5
19	--	3,000	<200	500	70	<20	10	50	<10	20	<2	<20	5
20	--	1,500	<200	300	30	<20	10	20	<10	<10	<2	<20	<5
21	<.1	2,000	<200	200	150	<20	30	70	<10	15	5	<20	7
22	--	2,000	300	300	300	<20	30	50	<10	15	5	<20	10
23	--	1,000	<200	500	70	<20	20	10	10	10	2	<20	<5
24[1]	--	5,000	<200	300	30	<20	10	20	<10	10	<2	<20	<5
25	--	3,000	1,500	700	500	30	30	30	<10	20	15	<20	5
					Metavolcanic rocks								
26	--	2,000	<200	700	300	<20	50	10	<10	10	<2	<20	20
27	--	2,000	<200	1,000	200	<20	10	5	<10	15	<2	<20	<5
28	--	3,000	<200	700	200	<20	30	50	10	15	<2	<20	15
29	--	2,000	<200	700	200	<20	30	15	20	15	<2	<20	20
30	--	2,000	<200	1,000	200	<20	30	10	10	10	<2	<20	20
31	<.1	1,500	<200	1,000	150	<20	15	50	15	20	<2	<20	7
32	--	2,000	<200	1,000	200	<20	30	50	<10	15	<2	<20	20
33	--	5,000	<200	1,000	300	<20	7	30	20	20	<2	<20	10
34	<.1	1,500	<200	1,000	100	<20	20	30	10	20	<2	<20	7
35	<.1	3,000	500	500	500	<20	30	50	30	20	<2	<20	7
36	<.1	3,000	<200	500	300	<20	30	15	<10	20	<2	<20	7
37[2]	<.1	3,000	<200	500	200	<20	5	100	<10	<10	<2	<20	15
38[2]	46	1,500	<200	500	150	<20	10	500	50	150	<2	<20	100
39[2]	24	2,000	<200	500	150	<20	7	2,000	<10	<10	<2	<20	50
40[2]	<.1	3,000	<200	500	200	<20	7	50	<10	10	<2	<20	15
41[2]	12	1,000	500	300	50	<20	7	15,000	<10	15	<2	<20	30
42[2]	.4	2,000	200	700	200	<20	15	200	<10	20	<2	<20	50
43[2]	3	1,500	<200	500	150	<20	<5	1,000	10	10	<2	<20	7
44[2]	<.1	3,000	<200	500	200	<20	15	50	<10	10	<2	<20	15
45	<.1	2,000	<200	500	200	<20	30	70	<10	20	<2	<20	7
46	<.1	2,000	<200	500	150	<20	20	50	<10	20	<2	<20	7
47[1]	--	3,000	<200	200	100	<20	5	3	<10	10	<2	<20	<5

See footnotes at end of table.

olation Valley primitive area

yses by Walter Ficklin, Sharon Noble, Elizabeth Martinez, John Watterson, and T. A. Roemer]

Sample	Semiquantitative spectrographic analyses (ppm)--Continued: Ag	Bi	As	Cr	Ba	Sr	Semiquantitative spectrographic analyses (percent): Fe	Mg	Ca	Rock description
					Metasedimentary rocks--Continued					
1	<0.7	<10	<200	30	700	100	2	1	0.7	Quartzo-feldspathic hornfels.
2	<.7	<10	<200	200	100	100	1.5	.7	.1	Micaceous quartzite.
3	<.7	<10	<200	70	500	500	5	.7	2	Calc-hornfels.
4	<.7	<10	<200	30	1,000	300	1.5	1	5	Do.
5	<.7	<10	<200	30	1,000	150	5	1.5	>10	Do.
6	<.7	<10	<200	300	100	300	5	3	3	Quartzo-feldspathic hornfels.
7	<.7	<10	<200	50	<20	<100	1	2	>10	Tactite.
8	<.7	<10	<200	200	150	300	5	3	3	Calc-hornfels.
9	<.7	<10	<200	100	<20	150	2	1	>10	Tactite.
10	<.7	<10	<200	50	100	500	2	1.5	>10	Calc-hornfels.
11	<.7	<10	<200	50	2,000	500	2	1	2	Do.
12[1]	<.7	<10	<200	50	500	300	5	1	2	Pelitic hornfels.
13	<.7	<10	<200	70	100	500	1.5	1	5	Calc-hornfels.
14	<.7	<10	<200	50	20	200	1.5	.7	7	Tactite.
15	<.7	<10	<200	70	700	1,000	2	2	7	Do.
16	<.7	<10	<200	20	100	300	2	1	10	Marble.
17	<.7	<10	<200	20	200	<100	1	.5	10	Calc-hornfels.
18	<.7	<10	<200	30	1,000	500	2	1	1	Quartzo-feldspathic hornfels.
19	<.7	<10	<200	30	700	500	2	.5	3	Calc-hornfels.
20	<.7	<10	<200	20	500	100	2	.7	1	Quartzo-feldspathic hornfels.
21	<.7	<10	<200	30	500	150	3	.7	3	Do.
22	<.7	<10	<200	50	1,000	500	5	1	1.5	Do.
23	<.7	<10	<200	20	300	500	1.5	1	>10	Marble.
24[1]	<.7	<10	<200	20	500	100	2	.7	1	Quartzo-feldspathic hornfels.
25	<.7	<10	<200	100	<20	150	1	.5	3	Calc-hornfels.
					Metavolcanic rocks--Continued					
26	<.7	<10	<200	200	300	500	7	3	2	Mafic hornfels.
27	<.7	<10	<200	50	700	200	5	2	1.5	Quartzo-feldspathic hornfels.
28	<.7	<10	<200	7	500	300	7	3	3	Pneumatolytic quartzo-feldspathic hornfels.
29	<.7	<10	<200	300	150	200	7	5	3	Quartzo-feldspathic hornfels.
30	<.7	<10	<200	200	1,000	200	7	5	3	Pneumatolytic quartzo-feldspathic hornfels.
31	<.7	<10	<200	20	1,000	300	3	1.5	>10	Quartzo-feldspathic hornfels.
32	<.7	<10	<200	200	500	300	7	5	3	Pneumatolytic quartzo-feldspathic hornfels.
33	<.7	<10	<200	20	700	500	7	3	5	Quartzo-feldspathic hornfels.
34	<.7	<10	<200	30	700	200	3	1.5	7	Do.
35	<.7	<10	<200	70	700	200	5	2	2	Do.
36	<.7	<10	<200	70	1,500	500	5	2	2	Do.
37[2]	<.7	<10	5,000	50	300	150	7	3	2	Pneumatolytic quartzo-feldspathic hornfels.
38[2]	<.7	30	30,000	20	30	70	>10	2	7	Quartzo-feldspathic hornfels.
39[2]	<.7	100	<200	20	150	70	7	2	1	Pneumatolytic quartzo-feldspathic hornfels.
40[2]	<.7	<10	<200	30	300	150	7	2	1.5	Do.
41[2]	10	<10	<200	10	150	100	5	.2	3	Quartzo-feldspathic hornfels.
42[2]	<.7	<10	<200	30	70	100	>10	5	2	Pneumatolytic quartzo-feldspathic hornfels.
43[2]	3	<10	<200	20	700	100	7	1	1.5	Quartzo-feldspathic hornfels.
44[2]	<.7	<10	<200	50	200	100	7	5	1	Pneumatolytic quartzo-feldspathic hornfels.
45	<.7	<10	<200	50	300	200	3	1.5	3	Calc-hornfels.
46	<.7	<10	<200	50	700	300	3	1	5	Do.
47[1]	<.7	<10	<200	5	200	500	3	.7	2	Amphibolite.

TABLE 1.—*Analytical data of the Desolat*

Sample	Au	Ti	Zn	Mn	V	La	Ni	Cu	Pb	Y	Mo	Sn	Co
	Semiquantitative spectrographic analyses (ppm)												
					Plutonic rocks								
48	--	2,000	<200	500	100	<20	<5	7	10	15	<2	<20	7
49	--	2,000	<200	500	70	<20	10	10	15	15	<2	<20	10
50[3]	--	700	<200	150	7	<20	<5	2	50	<10	<2	<20	<5
51	--	3,000	<200	500	150	<20	5	15	10	10	<2	<20	10
52	--	5,000	<200	1,000	150	<20	<5	50	<10	15	<2	<20	10
53	--	3,000	<200	500	150	<20	7	15	10	15	<2	<20	10
54	--	1,500	<200	500	70	<20	5	5	10	<10	<2	<20	5
55	--	1,500	<200	200	100	<20	5	5	10	<10	<2	<20	5
56	<0.1	300	<200	50	<10	<20	<5	20	<10	<10	<2	<20	<5
57	--	1,500	<200	300	70	<20	5	7	10	<10	<2	<20	5
58	--	2,000	<200	500	100	<20	5	10	10	15	<2	<20	10
59	--	5,000	<200	1,000	300	<20	15	50	<10	10	<2	<20	20
60	--	5,000	<200	700	300	<20	10	20	<10	20	<2	<20	15
61	--	2,000	<200	500	100	<20	<5	10	10	15	<2	<20	5
62	--	5,000	<200	500	200	<20	5	30	<10	10	<2	<20	15
63	--	5,000	<200	500	200	<20	10	100	<10	10	<2	<20	15
64	--	3,000	<200	700	150	30	<5	30	<10	15	<2	<20	15
65	--	3,000	<200	700	200	<20	<5	30	<10	15	<2	<20	15
66	--	5,000	<200	500	500	<20	15	30	<10	15	<2	<20	20
67	<.1	15,000	<200	200	50	<20	5	3	<10	10	<2	<20	<5
68	--	70	<200	50	<10	<20	<5	5	10	<10	<2	<20	<5
69	--	5,000	<200	500	200	<20	15	50	<10	10	<2	<20	15
70	--	3,000	<200	500	150	<20	5	30	<10	10	<2	<20	10
71	--	3,000	<200	500	150	<20	5	20	<10	10	<2	<20	10
72	--	2,000	<200	700	300	<20	20	10	<10	10	<2	<20	50
73	--	70	<200	<10	<10	<20	<5	5	<10	20	<2	<20	<5
74	--	2,000	<200	700	200	<20	15	50	<10	20	<2	<20	10
75	--	3,000	<200	500	200	<20	7	100	<10	<10	<2	<20	15
76	--	1,500	<200	700	50	<20	5	2	10	<10	<2	<20	5
77	--	1,000	<200	300	30	<20	5	15	10	<10	<2	<20	<5
78	--	2,000	<200	500	100	<20	5	5	10	<10	<2	<20	5
79[2]	1	200	<200	30	20	<20	<5	150	10	<10	<2	<20	<5
80	--	700	<200	300	10	<20	<5	10	10	<10	<2	<20	<5
81	--	2,000	<200	500	150	30	<5	20	10	15	<2	<20	10
82	--	3,000	<200	500	150	30	<5	20	10	15	<2	<20	10
83	--	3,000	<200	300	100	20	5	5	10	20	<2	<20	5
84	--	2,000	<200	500	100	<20	5	5	<10	<10	<2	<20	5
85	--	1,000	<200	100	20	<20	<5	5	10	<10	<2	<20	<5
86	--	3,000	<200	500	100	50	5	15	10	10	<2	<20	10
87	--	3,000	<200	700	200	<20	100	20	10	<10	<2	<20	20

See footnotes at end of table.

ley primitive area—Continued

	Semiquantitative spectrographic analyses (ppm)--Continued						Semiquantitative spectrographic analyses (percent)			
Sample	Ag	Bi	As	Cr	Ba	Sr	Fe	Mg	Ca	Rock description
						Plutonic rocks--Continued				
48	<0.7	<10	< 200	15	700	300	3	1	2	Granodiorite.
49	<.7	<10	< 200	15	1,000	500	3	1	3	Do.
50[3]	<.7	<10	< 200	<5	150	50	.3	.03	.3	Pegmatite.
51	<.7	<10	< 200	15	1,000	300	3	1.5	2	Granodiorite.
52	<.7	<10	< 200	<5	700	300	5	2	3	Do.
53	<.7	<10	< 200	15	1,000	300	3	1.5	2	Do.
54	<.7	<10	< 200	5	500	300	3	.7	1	Do.
55	<.7	<10	< 200	10	300	200	2	.5	.7	Do.
56	<.7	<10	< 200	<5	150	<100	1.5	.05	.2	Vein quartz.
57	<.7	<10	< 200	<5	500	200	2	.5	.7	Quartz monzonite.
58	<.7	<10	< 200	15	700	200	3	1.5	2	Do.
59	<.7	<10	< 200	100	300	700	7	3	5	Norite.
60	<.7	<10	< 200	15	700	300	7	3	5	Quartz diorite.
61	<.7	<10	< 200	15	1,000	300	3	1	1.5	Granodiorite.
62	<.7	<10	< 200	15	500	1,000	7	2	5	Norite.
63	<.7	<10	< 200	10	700	1,000	5	2	5	Quartz diorite.
64	<.7	<10	< 200	5	700	500	7	2	3	Do.
65	<.7	<10	< 200	20	500	500	7	2	3	Do.
66	<.7	<10	< 200	30	500	500	7	3	5	Do.
67	<.7	<10	< 200	5	300	100	2	.5	.5	Granodiorite.
68	<.7	<10	< 200	<5	1,000	100	.2	.05	.5	Alaskite.
69	<.7	<10	< 200	20	700	700	7	2	3	Quartz diorite.
70	<.7	<10	< 200	20	500	500	5	1.5	3	Decomposed quartz diorite.
71	<.7	<10	< 200	7	700	500	5	1.5	3	Granodiorite.
72	<.7	<10	< 200	300	100	500	10	3	2	Hornblende gabbro.
73	<.7	<10	< 200	<5	70	<100	.5	<.02	.2	Aplite.
74	<.7	<10	< 200	70	700	700	3	1.5	2	Rhyodacitic dike rock.
75	<.7	<10	< 200	30	700	500	5	3	3	Quartz diorite.
76	<.7	<10	< 200	<5	500	300	2	.5	.7	Granodiorite.
77	<.7	<10	< 200	<5	500	300	2	.3	.7	Iron oxide stained granodiorite.
78	<.7	<10	< 200	5	700	300	3	.7	1	Granodiorite.
79[2]	<.7	30	30,000	<5	70	<100	5	.15	.15	Quartzose fracture filling.
80	<.7	<10	< 200	<5	500	100	1	.1	.3	Iron oxide stained granodiorite.
81	<.7	<10	< 200	10	700	300	3	1.5	1.5	Granodiorite.
82	<.7	<10	< 200	5	1,000	300	3	1.5	2	Do.
83	<.7	<10	< 200	5	500	500	5	.7	1.5	Quartz monzonite.
84	<.7	<10	< 200	20	500	300	5	.7	1	Granodiorite.
85	<.7	<10	< 200	<5	200	<100	1	.1	.3	Alaskite.
86	<.7	<10	< 200	5	500	500	3	1.5	2	Granodiorite.
87	<.7	<10	< 200	300	500	500	5	3	1	Olivine basalt.

TABLE 1.—*Analytical data of the Desolat*

Semiquantitative spectrographic analyses (ppm)

[Ag <0.7, Bi <10, As <200, Sb <100]

Sample	Ti	Zn	Mn	V	La	Ni	Cu	Pb	Y	Mo	Sn	Co
				Panned concentrates from stream sediments								
101	10,000	<200	3,000	500	150	15	50	<10	50	<2	<20	20
102	2,000	<200	1,500	150	50	<5	7	<10	50	<2	<20	7
103	3,000	<200	2,000	200	300	7	15	<10	70	<2	<20	15
104	2,000	<200	500	30	100	<5	7	<10	15	<2	<20	<5
105	2,000	<200	2,000	200	100	10	7	10	150	<2	<20	10
106	5,000	<200	700	30	<20	<5	10	<10	20	<2	<20	5
107	7,000	<200	2,000	200	500	50	50	10	200	10	<20	50
108	>10,000	<200	3,000	300	700	50	50	10	500	10	20	50
109	>10,000	<200	3,000	300	700	30	20	10	500	15	20	50
110	>10,000	<200	1,000	300	150	10	20	<10	150	15	20	15
111	3,000	<200	2,000	150	300	10	15	<10	70	<2	<20	15
112	10,000	<200	1,500	150	70	30	15	<10	150	<2	20	15
113	5,000	<200	1,000	150	150	<5	10	<10	50	<2	<20	10
114	3,000	<200	1,500	200	100	5	3	10	70	<2	<20	5
115	>10,000	<200	2,000	300	20	5	20	<10	50	2	<20	10
116	2,000	<200	700	100	200	5	3	10	50	<2	<20	5
117	7,000	<200	2,000	200	50	15	15	<10	100	3	20	20
118	3,000	<200	1,000	150	100	5	5	<10	70	<2	<2C	5
119	7,000	<200	1,500	150	30	10	30	<10	100	<2	<20	15
120	1,500	<200	500	100	500	15	15	<10	30	<2	<20	7
121	10,000	200	1,500	300	200	10	20	<10	50	2	<20	10
122	10,000	<200	5,000	700	<20	15	50	<10	30	<2	<20	50
123	>10,000	<200	3,000	1,000	<20	10	50	<10	20	<2	<20	20
124	1,500	<200	500	70	<20	5	10	10	30	<2	<20	<5
125	7,000	<200	1,000	100	<20	5	10	<10	100	<2	<20	5
126	>10,000	<200	1,500	2,000	<20	30	50	<10	10	<2	<20	30
127	3,000	<200	1,500	150	50	10	15	<10	50	<2	<20	15
128	5,000	<200	1,500	700	100	10	10	<10	70	3	<20	15
129	10,000	<200	1,500	500	150	20	30	<10	50	2	<20	10
130	>10,000	<200	3,000	700	<20	15	70	<10	20	<2	<20	50
131	10,000	<200	2,000	200	<20	15	30	<10	50	<2	<20	20
132	>10,000	<200	2,000	300	<20	15	50	<10	20	<2	<20	20
133	10,000	<200	2,000	700	70	30	30	50	50	<2	<20	20
134	7,000	<200	2,000	200	50	10	15	<10	50	<2	<20	20
135	7,000	<200	1,500	300	<20	10	30	<10	30	7	<20	15
136	7,000	200	1,000	700	500	10	30	<10	200	2	<20	50
137	3,000	<200	700	300	20	10	2	<10	30	<2	<20	<5
138	7,000	<200	700	150	150	10	5	<10	30	<2	<20	7
139	10,000	<200	1,500	1,000	50	20	30	<10	20	<2	<20	30
140	5,000	<200	1,000	150	30	10	15	<10	20	<2	<20	15
141	7,000	<200	1,000	150	50	7	15	<10	30	<2	<20	15
142	3,000	<200	1,000	300	<20	20	10	<10	20	3	<20	15
143	3,000	<200	500	200	20	15	10	<10	30	<2	<20	5
144	7,000	<200	1,000	700	<20	15	20	<10	20	<2	<20	15
145	5,000	<200	2,000	200	100	20	20	<10	100	3	<20	20

lley primitive area—Continued

	Semiquantitative spectrographic analyses (ppm)--Continued					Semiquantitative spectrographic analyses (percent)		
Sample	Be	W	Cr	Ba	Sr	Fe	Mg	Ca
			Panned concentrates from stream sediments					
101	<1	<50	100	150	150	>10	3	5
102	<1	<50	20	500	150	5	1.5	2
103	<1	<50	30	200	150	7	2	3
104	<1	<50	5	500	150	1.5	.5	1
105	<1	<50	30	200	150	7	3	3
106	<1	<50	10	300	100	1.5	.5	1
107	<1	<50	50	200	100	7	5	7
108	1	<50	50	200	100	10	5	7
109	1	<50	50	300	150	3	5	7
110	<1	200	20	200	<100	7	2	2
111	<1	<50	20	200	150	7	3	3
112	<1	<50	20	150	100	3	3	3
113	<1	<50	20	700	100	5	2	1.5
114	<1	<50	20	200	<100	7	2	2
115	<1	<50	30	100	<100	>10	2	1.5
116	<1	<50	10	500	100	5	.7	1
117	<1	<50	20	150	100	7	3	3
118	<1	<50	20	200	<100	7	1	1
119	<1	<50	20	200	<100	5	3	3
120	<1	<50	30	500	<100	3	1	.7
121	<1	<50	300	70	150	10	1.5	3
122	<1	<50	50	70	<100	>10	3	1.5
123	<1	<50	50	150	100	>10	1.5	1.5
124	<1	<50	5	300	100	2	.5	.7
125	<1	70	70	150	<100	7	2	2
126	<1	<50	300	30	<100	>10	1	.3
127	<1	<50	10	300	200	7	1.5	2
128	<1	<50	100	70	100	>10	1.5	1.5
129	<1	<50	1,000	70	100	>10	1.5	2
130	<1	<50	70	70	<100	>10	3	2
131	<1	<50	30	150	100	7	3	3
132	<1	<50	30	150	100	>10	3	2
133	<1	<50	1,000	70	<100	>10	2	3
134	<1	<50	20	200	100	7	3	3
135	<1	<50	30	200	200	7	3	3
136	<1	50	300	200	<100	>10	2	2
137	<1	<50	700	500	300	2	1	7
138	<1	50	1,500	150	<100	5	1	1.5
139	<1	<50	150	70	<100	>10	2	2
140	<1	<50	20	300	300	5	2	3
141	<1	<50	20	300	200	5	2	3
142	<1	70	500	300	150	3	1	5
143	<1	<50	150	300	150	3	1	5
144	<1	<50	70	200	200	>10	2	3
145	<1	<50	30	100	70	7	3	5

TABLE 1.—*Analytical data of the Desola*

Sample	Ti	Zn	Mn	V	La	Ni	Cu	Pb	Y	Mo	Sn	Co
	Semiquantitative spectrographic analyses (ppm)											
	Panned concentrates from stream sediments--Continued											
146	3,000	<200	1,000	200	50	10	5	<10	30	<2	<20	20
147	3,000	200	700	500	<20	30	70	<10	20	5	<20	10
148	2,000	<200	1,000	500	<20	15	20	<10	20	2	<20	50
149	10,000	<200	2,000	1,000	100	15	50	<10	70	<2	<20	30
150	5,000	<200	1,000	700	50	20	100	<10	30	2	<20	20
151	7,000	<200	2,000	200	70	20	50	<10	70	<2	<20	20
152	2,000	<200	1,000	200	<20	20	50	<10	15	10	<20	15
153	3,000	<200	700	100	<20	7	10	<10	50	<2	<20	10
154	3,000	<200	1,500	300	50	15	15	<10	50	2	<20	10
155	2,000	<200	1,000	200	30	30	50	<10	15	<2	<20	15
156	2,000	<200	1,500	300	<20	30	20	<10	15	<2	<20	15
157	2,000	<200	700	150	<20	10	30	10	15	<2	<20	10
158	>10,000	<200	1,500	300	<20	20	5	<10	20	<2	<20	15
159	3,000	<200	1,000	300	30	20	50	10	20	<2	<20	15
160	7,000	<200	1,000	200	100	10	20	<10	50	2	<20	10
161	2,000	<200	1,000	300	<20	20	50	<10	20	3	<20	20
162	3,000	<200	1,000	300	<20	20	50	10	20	<2	<20	20
163	2,000	<200	1,000	300	100	30	70	10	30	<2	<20	50
164	2,000	<200	1,000	300	30	15	30	<10	30	<2	<20	15
165	3,000	<200	1,000	200	150	10	15	<10	20	7	<20	10
166	7,000	300	2,000	700	300	50	300	15	70	7	20	100
167	>10,000	<200	2,000	300	200	15	50	<10	100	5	<20	20
168	7,000	200	2,000	700	300	30	300	20	70	7	<20	150
169	10,000	300	1,000	700	100	20	5	<10	20	<2	<20	30
170	>10,000	<200	2,000	500	200	10	10	<10	200	2	30	20
171	10,000	<200	700	150	150	5	5	20	30	<2	<20	5
172	7,000	<200	700	500	700	7	10	<10	30	2	<20	10
173	>10,000	<200	2,000	700	50	10	15	<10	100	5	20	30
174	2,000	<200	500	50	<20	5	10	10	20	<2	<20	5
175	2,000	<200	500	70	70	5	2	<10	20	<2	<20	5
176	10,000	<200	2,000	70	70	20	20	<10	50	<2	<20	20
177	10,000	<200	1,000	300	300	10	20	<10	70	<2	<20	15
178	10,000	<200	700	500	100	20	20	<10	100	3	<20	20
	Mineral analyses											
H[4]min	2,000	<200	1,500	200	<20	10	10	<10	30	<2	<20	20
H mode	5,000	<200	5,000	300	20	30	30	<10	100	<2	<20	50
H max	10,000	<200	10,000	1,000	100	100	70	<10	200	<2	20	70
M[4]min	500	<200	700	1,500	<20	200	10	<10	<7	<2	<20	30
M mode	1,500	<200	700	2,000	<20	200	30	<10	<7	<2	<20	50
M max	3,000	<200	1,000	3,000	<20	200	100	<10	<7	<2	<20	70

1 Be 1; Be <1 in sample not footnoted.
2 Sample from Josie claims.

lley primitive area—Continued

Sample	Semiquantitative spectrographic analyses (ppm)--Continued					Semiquantitative spectrographic analyses (percent)		
	Be	W	Cr	Ba	Sr	Fe	Mg	Ca
			Panned concentrates from stream sediments--Continued					
146	<1	<50	7	200	100	7	1.5	1.5
147	<1	<50	100	500	300	7	3	3
148	<1	<50	200	150	<100	10	5	2
149	<1	<50	1,000	70	<100	<10	2	3
150	<1	50	500	100	200	7	3	3
151	<1	100	30	150	150	7	5	5
152	<1	<50	150	300	100	7	2	5
153	<1	<50	7	300	100	5	1	1.5
154	<1	<50	100	150	300	10	2	5
155	<1	<50	200	200	200	7	3	5
156	<1	<50	300	150	200	7	5	7
157	<1	<50	50	500	300	5	2	3
158	<1	<50	100	150	100	10	1.5	1.5
159	<1	<50	100	50	<100	7	3	5
160	<1	<50	70	200	200	10	1	1.5
161	<1	<50	150	200	500	7	1.5	7
162	<1	<50	150	150	500	7	3	5
163	<1	<50	150	100	200	7	3	7
164	<1	<50	300	150	300	7	3	5
165	<1	200	50	200	200	7	.5	5
166	<1	<50	1,000	50	1,000	>10	.7	7
167	<1	500	200	150	200	>10	2	5
168	<1	150	1,000	70	1,000	>10	.7	7
169	<1	<50	200	100	<100	>10	2	1.5
170	<1	<50	50	70	<100	>10	2	1.5
171	<1	<50	50	500	150	5	.7	1
172	<1	<50	50	500	200	10	.7	1
173	<1	<50	100	<20	<100	>10	1	1
174	<1	50	15	500	100	3	.5	.5
175	<1	<50	5	200	<100	3	.5	.7
176	<1	<50	150	70	<100	>10	2	2
177	<1	<50	70	200	150	>10	1.5	2
178	<1	<50	100	150	<100	10	2	1.5
				Mineral analyses				
H[4]min	<1	<50	10	7	<100	10	5	7
H mode	3	<50	70	50	<100	10	5	7
H max	15	<50	300	150	<100	>10	7	10
M[4]min	<1	<50	70	7	<100	>10	.02	.15
M mode	<1	<50	300	15	<100	>10	.03	.2
M max	<1	<50	700	100	<100	>10	.03	.3

[3] Li <200 ppm.
[4] H, 21 purified hornblendes, and M, 10 purified magnetites, all from granitic rocks of the southern Sierra Nevada.

area are given in table 1. These two minerals are generally the predominant constituents in panned concentrates from the primitive area; therefore, any appreciable difference between the composition of the panned concentrates and the mineral separates represents other heavy minerals that may be of economic interest. Results of the analyses and the small size of the stream deposits indicate that the likelihood of any commercially attractive placer deposits occurring within the area is negligible.

The eastern part of a group of 14 placer claims lies within the primitive area about 2 miles west of Mount Price (fig. 5). A panned concentrate, collected from the meager sediment of the one small stream that flows through the claimed area, does not contain any valuable minerals (table 1, specimen 169).

CONTACT-METAMORPHIC DEPOSITS

Tactite bodies in the northwestern part of the Mount Tallac pendant initially were considered geologically favorable for concentration of various metals, particularly the tungsten mineral scheelite. However, examination with an ultraviolet light failed to reveal the presence of scheelite; furthermore, tungsten was not detected in any rock samples that were analyzed spectrographically (table 1). Trace amounts

FIGURE 5.—Glaciated area along western boundary of Desolation Valley primitive area where placer claims were located. Claimed area in foreground. Mount Price in background. View looking east.

of tungsten were detected in panned concentrates at only a few localities (table 1). No tungsten deposits were seen in the drainage areas above these sample sites. Concentrations of zinc and lead were slightly higher in tactites (table 1, samples 7, 25, 35) than in surrounding rocks, but zinc and lead minerals were not seen in the deposits. The small size of the tactite bodies, the low content of metals in samples collected from them, and the absence of tungsten in tactites that were examined under ultraviolet light indicated that the contact-metamorphic bodies do not warrant further exploration.

FRACTURE FILLINGS

Fractures containing gold-bearing sulfide minerals cut the hornfels of the Mount Tallac pendant about half a mile south of Gilmore Lake in the NE¼ sec. 17, T. 12 N., R. 17 E., and are most abundant atop a north-trending ridge between elevations of 8,000 and 8,200 feet. The Josie, Josie I, and Josie II claims, asserted to have been for a clay deposit, were located in December 1931 by A. L. Stewart. A year later they were quitclaimed to H. W. Hawkin. Several trenches and pits as much as 6 feet deep and 150 feet long were dug, but no production was recorded. The claims were abandoned in 1938.

The north-trending ridge is underlain chiefly by massive fine-grained dark metavolcanic quartzo-feldspathic hornfels. Locally, textures characteristic of volcanic tuffs have been preserved in the metamorphic rock; however, the massive nature is generally suggestive of volcanic flows.

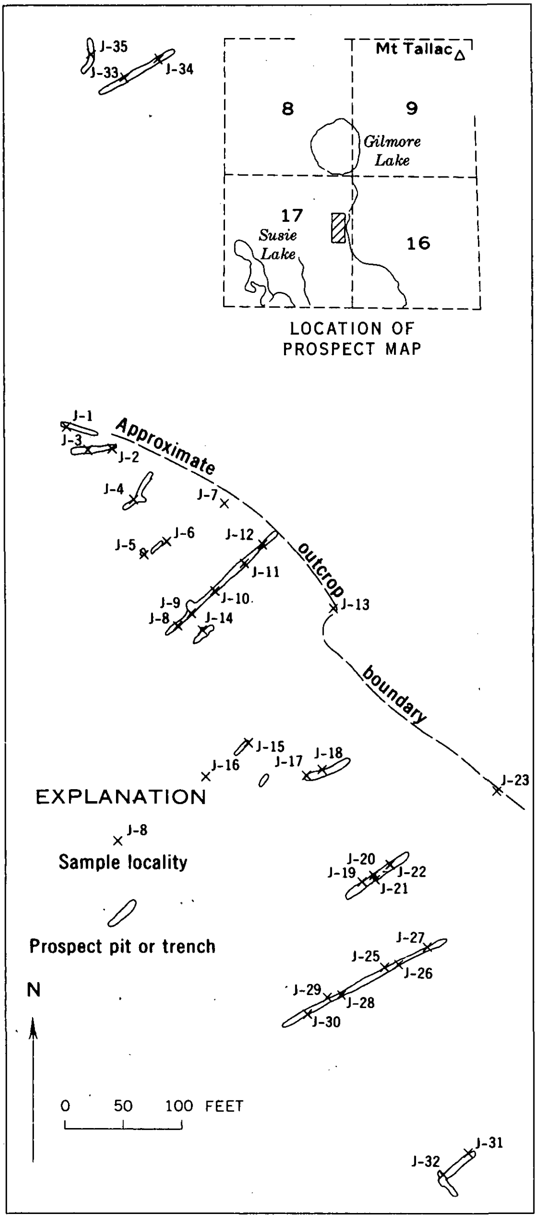
The greater part of the mineralized zone is within a semirectangular area roughly 500 feet long and 150 feet wide trending N. 45° W. across the ridge crest; however, sulfide-bearing material was recognized for more than 1,300 feet northwest and 150 feet southeast of the most strongly mineralized area. Some sulfide minerals are disseminated in the country rock; otherwise, there appears to be no alteration of country rock related to sulfide deposition. The mineralized fractures strike northwestward, and most of them dip from 35° to 60° NE. The largest of the mineralized fractures are 2–5 inches across, but the thickness of single veinlets is highly variable. Stringers and lenticules a fraction of an inch thick are common. Fine-grained quartz is the most abundant constituent of the veinlets. Pyrite, pyrrhotite, arsenopyrite, and chalcopyrite are the principal sulfide minerals. Trace amounts of other minerals include tourmaline, chlorite, and epidote.

During the reconnaissance stage of this study nine samples were taken at intervals of about 75 feet, south to north, across the area of heaviest mineralization, where the material appeared to be the richest in sulfide minerals. Analyses of these samples indicate concentrations of gold as high as 46 ppm (parts per million). (See table 1.) Compared with other rocks of the area, these rocks also contain greater-than-normal—though not particularly significant—amounts of copper, arsenic, bismuth, lead, and silver.

The abnormal gold values obtained from the mineralized zone led to further examination of the area. A map of the mineralized area was prepared (fig. 6), and 39 additional samples were collected and analyzed for gold (table 2). Samples of all the largest, and most of the sulfide-rich, fracture fillings and typical mineralized and unmineralized rocks within the workings were collected. All sample localities except four are plotted on figure 6. The four not shown, two of which are from a small area of rock containing sparse disseminated sulfides, were collected from points that are 800–1,100 feet northwest of the northernmost trench. In general, the rock between trenches appears to be free of larger veinlets but commonly contains disseminated sulfide grains.

Gold values of the samples that were collected during the reexamination of the prospect are considerably lower than those determined earlier, but gold is present in most of the analyzed samples. Of the 39 samples taken during the reexamination, 10 contained more than 1 ppm gold. The richest concentrations of gold (samples J–18 and J–20) are in two fracture fillings that are rich in sulfides. These samples contained 9.5 and 6.5 ppm, respectively, the richer of the two being equivalent to about $10 per ton in gold. Insofar as known from the surface exposures, the deposit is too low in grade, the gold is too erratically distributed, and the area too difficult of access to be commercially exploitable at present (1966). The deposit is near enough to commercial size and grade, however, to warrant exploration to determine its character and dimensions beneath the surface.

Evidence of sulfide-bearing fracture fillings were not found elsewhere in the primitive area; however, trace amounts of fine-grained pyrite commonly are disseminated in the hornfelsic rocks. Analyses of these rocks indicate no unusual concentrations of base or precious metals.



Mapped by J. P. Albers,
F. C. W. Dodge, and
W. A. Duffield, 1966

FIGURE 6.—Prospect south of Gilmore Lake.

TABLE 2.—*Atomic absorption gold analyses of samples from the Josie claims*

[Analysts: Elizabeth Martiñez, W. L. Campbell, and T. A. Roemer. Material: A, barren-appearing hornfels; B, hornfels with disseminated sulfides; C, hornfels containing stringers of sulfides; D, sulfide-rich fracture filling]

Sample	Au ppm	Material	Sample	Au ppm	Material
J-1	0.45	A	J-21	0.35	C
J-2	3.5	C	J-22	.7	B
J-3	.35	A	J-23	.3	B
J-4	.8	C	J-24	1	C
J-5	.5	B	J-25	.5	C
J-6	1	D	J-26	2.5	D
J-7	.35	A	J-27	.3	B
J-8	.35	B	J-28	.6	D
J-9	.85	B	J-29	.5	C
J-10	.65	B	J-30	.6	C
J-11	.35	B	J-31	<.1	A
J-12	.35	A	J-32	.35	D
J-13	.45	A	J-33	<.1	A
J-14	1.3	C	J-34	<.1	A
J-15	1.5	B	J-35	1.15	B
J-16	.4	B	J-50	<.1	A
J-17	.35	B	J-51	<.1	B
J-18	9.5	D	J-52	.45	B
J-19	5.5	D	J-53	.2	A
J-20	6.5	D			

OTHER POTENTIAL MINERAL DEPOSITS

In few geologic environments within the primitive area, other than those already mentioned, is there any likelihood of occurrence of valuable mineral commodities. Both pegmatites and massive quartz veins are exceedingly rare and, where present, are only a few inches thick. Neither contain minerals of economic interest. The iron-oxide-stained granitic rocks show little enrichment in base or precious metals over their unstained counterparts.

Panned concentrates of sediments from two streams that drain areas of metavolcanic and plutonic rocks in the eastern-central part of the area contain large amounts of magnetite. Undoubtedly, much of this magnetite was derived from noritic and associated igneous rocks which commonly contain more than 5 percent magnetite. However, the probability that an economically significant iron deposit exists in the area is negligible.

Sand and gravel deposits within the primitive area are small and inaccessible; consequently, they have no potential economic value. Granitic rock in Desolation Valley would be suitable for use as dimension stone; however, the inaccessibility of the area precludes any possibility of commercial potential.

CONCLUSIONS

With the possible exception of the gold-bearing area near Gilmore Lake, there is little probability that mineral deposits of economic value exist within the primitive area. This conclusion is based princpally on geological evaluation of the area supplemented by geochemical data. Furthermore, in more than a century of prospecting in the Sierra Nevada, no productive mineral deposits have been discovered in, or immediately adjacent to, the primitive area, and only a few claims have been filed in the area.

The gold-bearing rocks half a mile south of Gilmore Lake will require subsurface exploratory work before their economic potential can be assessed.

REFERENCES

Lindgren, Waldemar, 1896, Description of the Pyramid Peak quadrangle, California: U.S. Geol. Survey Geol. Atlas, Pyramid Peak Folio 31.

——— 1897, Description of the Truckee quadrangle, California: U.S. Geol. Survey Geol. Atlas, Truckee Folio 39.

——— 1911, The Tertiary gravels of the Sierra Nevada of California: U.S. Geol. Survey Prof. Paper 73, 226 p.

Loomis, A. A., 1960, Petrology of the Fallen Leaf Lake area, California: Stanford, Calif., Standford Univ., Ph.D. dissertation.

——— 1962, Chemistry, lithology, and structure of mid-Jurassic metavolcanic sequence, Sierra Nevada, California: Internat. Assn. Volcanology Symposium, Tokyo, Japan, Abs., p. 31–32.

——— 1963, Noritic anorthosite bodies in the Sierra Nevada batholith: Mineralog. Soc. America Spec. Paper 1, p. 62–68.

——— 1964, Geology of the Fallen Leaf Lake quadrangle: California Div. Mines open-file report.

——— 1966, Contact metamorphic reactions and processes in the Mount Tallac roof remnant, Sierra Nevada, California: Jour. Petrology, v. 7, p. 221–245.

McAllister, J. F., 1936, Glacial history of an area near Lake Tahoe: Stanford, Calif., Stanford Univ., M. A. thesis.

Peikert, E. W., 1958, The Mount Tallac roof pendant, Sierra Nevada, southwest of Lake Tahoe: California Univ. [Berkeley], M. A. thesis.

Peikert, E. W., 1962a, Three-dimensional specific-gravity variation in the Glen Alpine stock, Sierra Nevada, California: Geol. Soc. America Bull., v. 73, no. 11, p. 1437–1441.

——— 1962b, Three-dimensional mineralogical variation in the Glen Alpine stock, Sierra Nevada, California [abs.]: Geol. Soc. America Spec. Paper 73, p. 214.

Williams, Howell, Turner, F. J., and Gilbert, C. M., 1955, Petrography—an introduction to the study of rocks in thin sections: San Francisco, Calif., W. H. Freeman & Co., 406 p.; repr. 1958.

○