Mineral Resources of the Ventana Primitive Area Monterey County, California

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STUDIES RELATED TO WILDERNESS—PRIMITIVE AREAS

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An evaluation of the mineral potential of the area

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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 Ventana primitive area, California. The area discussed in the report corresponds to the area under consideration for wilderness status. It is not identical with the Ventana 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 Ventana primitive area.

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

CONTENTS

ILLUSTRATIONS

TABLES

STUDIES RELATED TO WILDERNESS—PRIMITIVE AREAS

MINERAL RESOURCES OF THE VENTANA PRIMITIVE AREA, MONTEREY COUNTY, CALIFORNIA

By Robert C. Pearson and Philip T. Hayes, U.S. Geological Survey, and Paul V. Fillo, U.S. Bureau of Mines

SUMMARY

A minerals survey of the Ventana primitive area was made by the U.S. Geological Survey during the summer of 1966, and the area was visited again briefly in January 1967 by Geological Survey and U.S. Bureau of Mines personnel. The area includes about 185 square miles in a rugged part of the California Coast Range southeast of Monterey. It is formed largely of metamorphic rocks of probable Paleozoic age which have been intruded by a wide variety of plutonic rocks of Jurassic to Cretaceous age. The crystalline rocks are locally overlain by sedimentary rocks ranging in age from Late Cretaceous to early Miocene. All the rocks have been broken by faults many of which have a northwest trend.

Geologic examination along several hundred miles of foot traverse and semiquantitative spectrographic and chemical analyses of more than 500 samples of stream sediments and bedrock did not indicate any mineral deposits of economic significance. Stream-sediment samples were collected from many points along all the major drainage courses and from most of their tributaries. Samples also were taken of all the major and most of the minor varieties of bedrock in the area and included much altered rock from fault zones and elsewhere. A few of the samples contained traces of copper, lead, zinc, and molybdenum in amounts that seemed to be anomalously high, although below ore grade. Some of these localities were revisited and sampled extensively in January 1967. Most of the relatively high values are from samples of weathered sulfide-bearing gneiss or of stream sediments derived from areas where such rock is abundant. These rocks are not considered to be of economic value.

No mineral deposits were known previously in the Ventana primitive area and none were discovered during this investigation. In the surrounding region, large mercury deposits and less important deposits of chromite, manganese, and asbestos are known, but they all occur in a rock formation that is not in the primitive area. Similarly, oil, gas, and diatomite produced in nearby areas are in rocks younger than any in the primitive area. Rocks similar to some in the primitive area contain small copper deposits in nearby localities, but only traces of copper were found within the primitive area. Lenses of marble having a composition suitable for a source of lime are present in small bodies, mostly in rugged terrane remote from transportation. Larger and much more accessible

bodies of marble are available immediately west of the area, but these have not been commercially exploited to date.

GEOLOGY AND MINERAL RESOURCES

By Robert C. Pearson and Philip T. Hayes
U.S. Geological Survey

INTRODUCTION

LOCATION AND GEOGRAPHY

The Ventana primitive area in Los Padres National Forest includes about 185 square miles of the Northern Santa Lucia Range, Monterey County, Calif. (fig. 1). The area is about 27 miles long and 4 to 9 miles wide.

The Ventana primitive area is an anachronism in mid-20th-century California. It is only a few hours drive from two major metropolitan areas, and it is almost within sight of two of the most heavily traveled highways in the State. The scenic coast highway (California Highway 1) parallels the primitive area at a distance of 2 to 5 miles, and U.S. Highway 101 lies in the Salinas River valley to the northeast. Thousands of people drive within 15 miles of the area each day, but despite its proximity to civilization, only a few hundred people penetrate more than a mile into it each year.

The primitive area through much of its length is only 2 to 5 miles from the coast—its southwest boundary coincides with the crest of the coast ridge 3,000 to 4,000 feet above the ocean. The northwest-trending Santa Lucia Range rises abruptly from the rugged and scenic Pacific coast and is flanked 25 miles to the northeast by the broad flat Salinas River valley. The range ends on the northwest at Monterey Bay, about 10 miles from the primitive area.

The area is drained by four major streams: the Big Sur and Little Sur Rivers to the southwest; the Carmel River to the northwest; and the Arroyo Seco, a tributary to the Salinas River, to the northeast. The topography of the area is influenced by the northwest-trending geologic structure, and many of the streams follow valleys thus oriented (fig. 2).

The southeastern part of the area is accessible by way of the Arroyo Seco Road from the Salinas River valley to Arroyo Seco Guard Station. From this point the Indians Road, a graded public road, parallels part of the southeast boundary of the area at a distance of about 1 mile. A U.S. Forest Service limited-access road from Posts on California Highway 1 coincides with the primitive area boundary about 8 miles along its southwestern edge. The private roads to Tassajara Hot Springs and to The Caves approach to within 1 mile of the eastern part of the primitive area. A public road to Bottchers Gap comes to

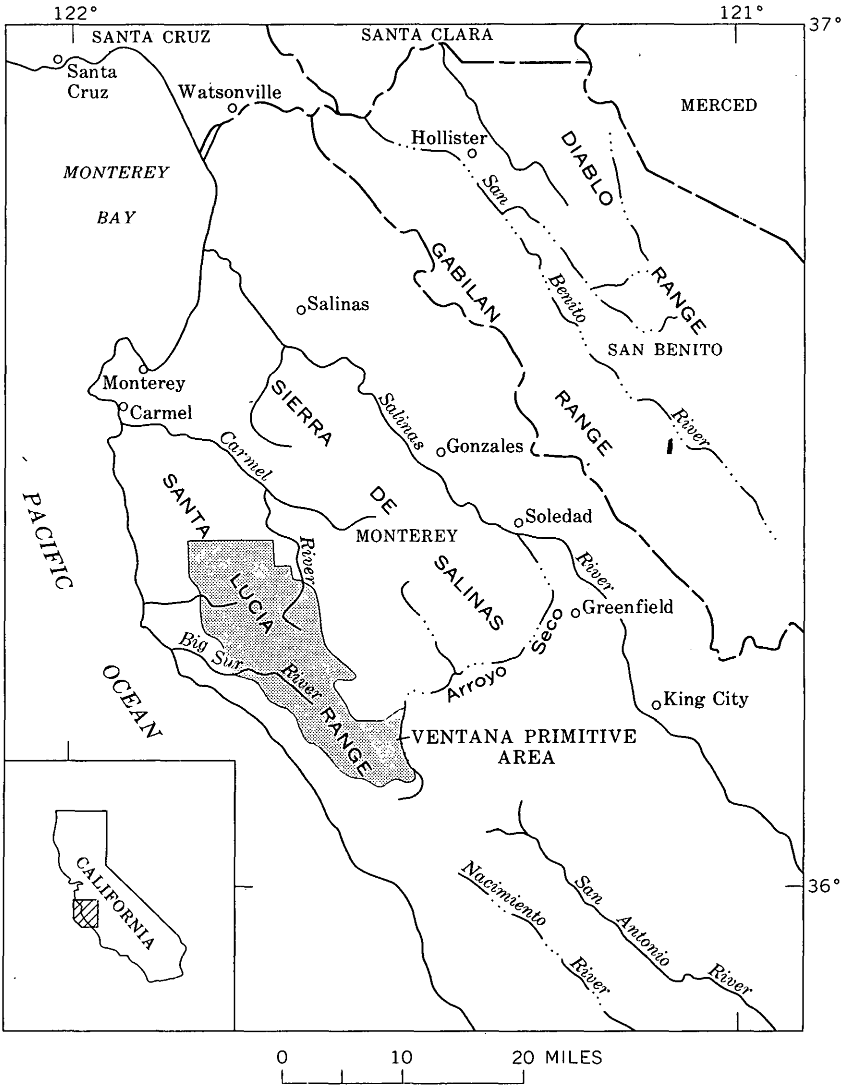

FIGURE 1.—Index map showing location of Ventana primitive area.

within 1 mile of the northwestern part. Several other private roads approach the periphery of the northern third of the area. Travel within the area is by foot or horseback on a very good network of U.S. Forest Service trails.

Topographically the area is characterized by steep-sided sharp-crested ridges separated by V-shaped youthful valleys. Over much of their length the streams flow on bedrock or a veneer of boulders; alluvial deposits along their courses are small or absent. Many of the

264-034 O—67——2

streams occupy narrow canyons with vertical walls; waterfalls are common, and deep pools occupy the valley floor from wall to wall in places. Elevations range from about 600 feet where the Big Sur River leaves the area to 4,965 feet on South Ventana Cone.

Virtually the entire area is covered by timber or brush (fig. 3). Along the Big Sur and Little Sur Rivers beautiful stands of redwood occur as far as 6 miles from the coast and at elevations up to about 2,000 feet. Some of the slopes and ridgetops are fairly open live oak and madrona forest and here and there are virgin stands of

FIGURE 2.—View up the North and South Forks of the Big Sur River from Ventana Double Cone showing the northwest-trending ridges that form this part of the Santa Lucia Range. Beyond limits of primitive area is Junipero Serra Peak, highest in the range, in distance at left. Southwest boundary of primitive area lies along skyline ridge at right.

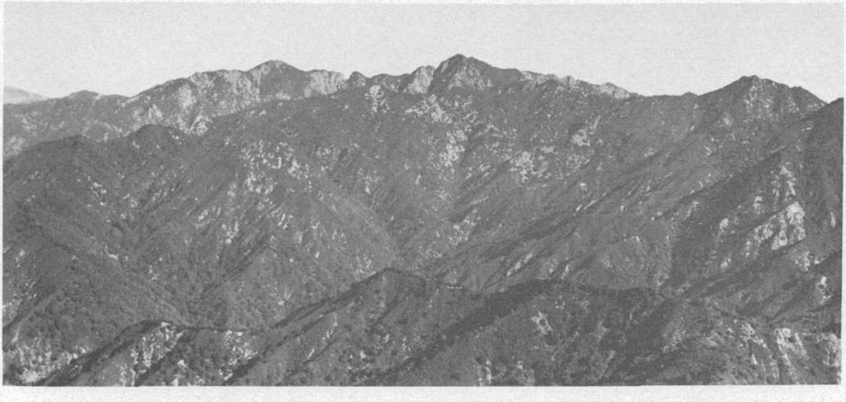

FIGURE 3.—Aerial view of Ventana Double Cone from southeast. Brush-covered slopes like this are typical of much of the primitive area.

ponderosa pine. Most of the area, however, is mantled by dense chaparral. The climate is mild throughout the area, but precipitation, which falls mainly from December to April, ranges widely from more than 100 inches a year along the coast ridge to only about 20 inches a few miles farther inland. At Cold Spring Camp, only a few hundred feet outside the primitive area near the head of Logwood Creek, precipitation of 161 inches recorded in the 12-month period from July 1940 to June 1941 is the greatest recorded in California (Waananen and Bean, 1966, p. 457). Snow occasionally falls on the higher peaks. Coastal fog and cool sea breezes frequently penetrate up the major valleys but rarely top the ridges, so most of the area is hot and dry in summer.

PREVIOUS WORK

The geology of the Ventana primitive area was fairly well known prior to the present investigation. Reports by Trask (1926), Reiche (1937), and Fiedler (1944) describe the rocks and structure and include geologic maps at a scale of about 1 mile per inch that cover all of the primitive area except about 1 square mile of the southeasternmost tip. The geology of that square mile has been studied by Compton (1966) and his coworkers as part of the geologic mapping of the Junipero Serra quadrangle. Earlier reconnaissance studies of the region and detailed studies in nearby areas were cited by these workers. Investigations dealing with stratigraphy of the Tertiary rocks and petrology of some of the crystalline rocks have been described by Dickinson (1965) and Compton (1960a). The geology of the northern part of the primitive area has recently been mapped in detail by Robert A. Wiebe as part of a Ph.D. dissertation at Stanford University. This report has not yet been published and was not available to the writers; however, Mr. Wiebe was very helpful in discussing the geology of this area with us.

PRESENT WORK AND ACKNOWLEDGMENTS

The writers, with the assistance of Robert W. Sullivan, spent about 2 months in the primitive area from July to September 1966 and examined the rocks for evidence of mineralization, checked existing geologic maps, and systematically sampled rocks and stream sediments. The fieldwork was performed by foot traverse along the existing trails, most stream courses, tractor trails along many ridgetops, and, in places, cross country. Some traverses were made into the area from various points on the periphery, others from camps within the area, and still others by means of helicopter. The area was revisited for a week in January 1967 to reinvestigate certain parts as a result of analytical tests on previously taken samples.

Analytical tests for mercury were made on most of the samples in a mobile field laboratory by Robert Hanson and Roger Miller, U.S. Geological Survey. The other analyses were made in Geological Survey laboratories in Denver, Colo., and in Washington, D.C.

Fieldwork in the primitive area was greatly facilitated by Mr. Alex Campbell, District Ranger, U.S. Forest Service, and members of his staff, particularly Mr. Doug McChesney, whose detailed knowledge of the area was invaluable, and Emil Pozzi, William Clark, and M. H. Netland, who provided horse-packing services and other assistance. A helicopter under contract to the Forest Service and based at the Arroyo Seco Guard Station was used for field transport and we are indebted to Mr. Fred Dearing, its capable pilot. Mr. Frisby at Pico Blanco Boy Scout Camp and numerous property owners kindly permitted access to the area over private roads and trails.

GEOLOGY

GEOLOGIC SETTING

The northern Santa Lucia Range is part of a northwest-trending block of crystalline rocks about 40 miles wide and more than 300 miles long. The crystalline block is bounded on the northeast by the San Andreas fault, some 30 miles northeast of the primitive area, and on the southwest by the Sur-Nacimiento fault, which skirts the coast and passes out to sea west of the area. Sedimentary and associated igneous rocks of the Franciscan Formation of Jurassic and Cretaceous age have been faulted against the crystalline block on both the northeast and southwest sides. These Franciscan rocks are not present within the block. Throughout its length, the crystalline block is discontinuously covered by a blanket of unmetamorphosed sedimentary rocks of Late Cretaceous and Tertiary age.

The primitive area lies within one of the largest areas of exposure of the pre-Upper Cretaceous or crystalline rocks. In this vicinity (pl. 1) these rocks consist of an older group of metamorphosed sedimentary and possibly volcanic rocks and a younger group of plutonic igneous rocks that intruded the metamorphic rocks.

Unmetamorphosed sedimentary rocks cover the crystalline rocks of large areas in the general region but are present in only about 10 percent of the primitive area, mainly in the southern part. These strata were deposited on the crystalline rocks after uplift and much erosion. Those immediately overlying the older rocks differ in age from place to place. Thus, during much of the last hundred million years the area of the northern Santa Lucia Range has been alternately above and below sea level, at times being eroded and at times receiving sediment. During the last 10 million years the range was uplifted to approximately its present height of up to 5,000 feet. This uplift took place by arching and by movement along many faults. During and since this uplift the sedimentary rocks have been eroded from much of the area, and they are now preserved only as down-faulted blocks and thin fault slices.

ROCKS OF THE SUR SERIES OF TRASK

The oldest rocks in the primitive area are a diverse group of metamorphic rocks called the Sur Series by Trask (1926). They form the bedrock in more than half the area. These rocks tend to be deeply weathered and poorly exposed except along perennial streams where erosion has kept pace with weathering.

The metamorphic terrane consists of a series of sedimentary and possibly volcanic rocks that have been metamorphosed to gneisses and schists of various types. The most abundant are quartz-rich gneisses that contain variable amounts of feldspar and biotite. Throughout the area these are interlayered with biotite schist, amphibolite, marble, and calc-silicate gneiss. To some extent all the gneisses and schists are gradational with one another. Nearly all the metamorphic rocks have a conspicuous foliation. The strong layering in the better exposures is indicative of the original sedimentary bedding.

The quartzose gneisses range from quartzite to biotite-quartz gneiss, quartz-feldspar gneiss, and biotite-quartz-feldspar gneiss. Locally, they also contain garnet, sillimanite, hornblende, graphite, or sulfide minerals. Light-colored quartzose gneisses, particularly quartz-feldspar gneiss, are characteristic of the southwestern part of the primitive area; in the central and northeastern parts of the area the gneisses are generally a darker gray because of a greater biotite content. Some of the quartz-feldspar gneisses may have been derived from igneous rocks as suggested by Reiche (1937, p 119). Quartzite containing very small amounts of other minerals forms lenticles and layers as much as a few inches thick in most of the quartz-feldspar gneiss, but in the biotitic gneisses it forms discrete beds several feet thick and locally is the principal component of sequences up to several hundred feed thick, as in upper Redwood Creek, North Fork Big Sur River, and along the Arroyo Seco.

Mica-rich schist occurs widely in thin discontinuous layers in the gneisses and in places forms units 100 feet or more thick, as along the North Fork of Big Sur River south of Cienega Creek. The schist commonly contains sillimanite and garnet.

Dark green to black, foliated to massive amphibolite is also widespread as generally concordant layers from a few inches to many tens of feet thick. It consists of hornblende and plagioclase and subordinate biotite and pyroxene. Amphibolite is the dominant metamorphic rock of large areas along Zigzag Creek.

Marble and calc-silicate gneiss form pods and discontinuous layers throughout the metamorphic sequence but are most abundant along the southwestern edge of the primitive area. The largest bodies of relatively pure marble are shown separately on plate 1. The marble is more resistant to weathering than any other rock in the area, and consequently it generally forms prominent outcrops and is recognizable from a distance even where the brush is thick. Bodies of marble range from about 1 foot thick and a few feet long to about 100 feet thick and more than 1,000 feet long. The marble is generally white and finely to coarsely crystalline; most of it contains some crystalline graphite. The marble is generally associated with calc-silicate gneiss, and the two grade into one another. The most conspicuous minerals of the calc-silicate gneiss include wollastonite, diopside, garnet, scapolite, and amphibole. Layered sequences of calc-silicate gneiss tend to be thicker and more continuous than the associated marble; in Redwood Creek and North Fork Big Sur River they attain a thickness of several hundred feet.

Rocks of the Sur Series of Trask (1926) originally were sandy, muddy, and limy sediments that probably were many thousand feet in thickness. They probably included some interbedded basaltic lava flows. The age of these sediments is not known but is generally thought to be Paleozoic or even Precambrian. The sediments were folded, metamorphosed to gneisses and schists, and intruded by igneous rocks in middle to late Mesozoic time.

INTRUSIVE ROCKS

Plutons with a wide range of composition have intruded the metamorphic rocks throughout the primitive area. The bodies range from irregular veinlets less than 1 inch in thickness to stocks many square miles in area. Only the larger bodies are shown on plate 1. The larger bodies are more resistant to erosion than the surrounding gneisses and schists, hence they tend to form the highest peaks and ridges. No extensive hypogene alteration associated with the igneous rocks was noted.

Nearly every outcrop of metamorphic rocks is cut by small bodies of light-colored intrusive rock that includes granite pegmatite, alaskite, and luecotonalite and consists mainly of quartz and feldspars and commonly some biotite and garnet. The larger plutons are mostly quartz diorite and granodiorite although quartz monzonite, granite, diorite, and gabbro are also present. The largest area of plutonic rock extends from the vicinity of Ventana Cone northwestward to beyond the primitive area boundary. It is mainly gray gneissic even-grained biotite-hornblende quartz diorite to granodiorite. Although the rock is fairly homogeneous over large areas, parts of it, especially near its borders, are more potassic. More than one pluton may be present. An elliptical pluton between Skinner and Pine Creeks (Little Sur River tributary) is a distinctive porphyritic quartz monzonite with pink potassium feldspar phenocrysts and occasional garnet. Similar rock is also present along the Carmel River near the mouth of Miller Fork and in Pine Creek (Carmel River tributary).

The plutons in the southeastern half of the primitive area are smaller and more nonhomogeneous than those to the northwest. They are pegmatoid in part, contain less hornblende and more potassium feldspar, and include abundant septa of metamorphic rocks. As these features are characteristic of the border zones of the quartz diorite and granodiorite plutons farther northwest (fig. 4), those in the southeast may be the roof parts of plutons not yet eroded as deeply.

Gabbro and diorite form a nonhomogeneous pluton exposed along the Carmel River southwest of Pine Valley. The rocks are fine to medium grained, dark gray to black, and foliated to massive. A fine-grained dark gray weakly foliated rock specimen examined microscopically consists of hornblende and labradorite. Smaller bodies of

FIGURE 4.—View west from Ventana Double Cone toward rugged ridge of granitic rocks and septa of metamorphic rocks. Post Summit on primitive area boundary is in distance at left. Pico Blanco, in distance at right, is beyond limits of primitive area.

similar mafic rocks are also common along the Carmel River for a few miles farther downstream.

SEDIMENTARY ROCKS

Sedimentary rocks of Late Cretaceous and Tertiary age lie on the older crystalline rocks in the southern part of the primitive area and are locally preserved in down-dropped wedges along faults in the northern part. Locally, as in the Church Creek area (Dickinson, 1965), these rocks have been studied in some detail, the sequence subdivided, and several stratigraphic names assigned. Such local stratigraphic studies and the identification of diagnostic fossils have established the age and conditions of deposition in some places. The picture is incomplete, however, and in this report only a general description of the rocks and their depositional history is given.

The oldest and most widespread of the sedimentary rocks is a sequence of interbedded conglomerate, sandstone, siltstone, and claystone in the southern part of the area. These rocks were studied by Reiche (1937) and fossils collected by him indicate a Late Cretaceous age. Reiche estimated the maximum thickness of the sequence to be 6,000 feet. Nearly everywhere in the primitive area the Upper Cretaceous rocks are strongly faulted and only at a few places are depositional contacts with the older rocks exposed at the surface. Commonly the basal beds are pebble and cobble conglomerates that have an indurated sandy matrix. Similar beds and lenses recur at numerous places throughout the section. Bedding in the conglomerate is generally well defined. The pebbles and cobbles are well rounded and are mainly composed of granitic rocks, porphyry, quartzite, chert, and metamorphic rocks. The granitic and metamorphic rocks could have been locally derived, and the chert may have come from the Franciscan Formation. The most conspicuous of the sedimentary rocks are resistant massively bedded medium- to coarse-grained feldspathic sandstone, which weathers buff to light brown. Finer grained and more poorly sorted sandstone is also common. Many of the sandstones are pebbly. Probably the most abundant rocks in the sedimentary sequence are sandy siltstone, siltstone, mudstone, and claystone, that vary from medium to dark gray to greenish gray. These rocks are relatively nonresistant and not well exposed. Many of the siltstones and claystones contain abundant nodular concretions, some of which have formed around fossil plant fragments.

Strata of Paleocene, Eocene, and Oligocene age have been identified in the southeastern part of the primitive area (Compton, 1957), on the ridge north of Higgins Creek (Reiche, 1937, p. 144), and along Tassajara and Church Creeks (Dickinson, 1965). Lithologically, these strata are very similar to those of Late Cretaceous age described in the preceding paragraph, and they have been distinguished chiefly on the basis of their fossil content. The Paleocene rocks lie with apparent conformity on Upper Cretaceous rocks except along the Willow Creek fault, where they lie directly on the crystalline rocks. Along the Church Creek fault sedimentary rocks of middle to late Eocene age rest directly on the crystallines. Strata of Oligocene age overlie the Eocene rocks in the Church Creek area, and very locally in the extreme southeastern part of the area lower Miocene sedimentary rocks unconformably overlie older Tertiary strata.

Some of the thin wedges of sedimentary rocks along faults in the northern part of the area have not been definitely correlated with other rocks in the vicinity and their age is uncertain.

STRUCTURE

The structure of the metamorphic rocks is poorly known, but on the basis of scattered observation the rocks probably are folded strongly rather than being a faulted homoclinal sequence as suggested by Trask (1926, p. 127) and Reiche (1937, p. 156). Fiedler (1944, p. 184–185) considered the likelihood that the metamorphic rocks are folded. Although the dominant strike is northwesterly and the dip northeasterly, abrupt changes in attitude are common in some areas. Minor folds and well-developed mineral lineation also suggest that the sequence is strongly folded.

The sedimentary rocks in the primitive area have been moderately deformed by faulting. No folds of more than local importance have been recognized, and Reiche (1937, p. 156–157) suggests that the synclinal nature of some fault blocks is caused by drag along the faults. The sedimentary rocks have been strongly folded where they are more extensively exposed in areas bordering the primitive area. In the Junipero Serra quadrangle southeast of the primitive area, Compton (1960b, 1966) concluded that the crystalline core of the Santa Lucia Range was folded along with the overlying sedimentary rocks and that these folds were then cut by high-angle faults during Pliocene and Pleistocene uplift of the range. It seems likely, therefore, that the homoclinal fault blocks within the primitive area are the faulted remnants of folds.

The principal faults recognized within the primitive area trend northwest, parallel to the major structural elements of the region. They all seem to dip steeply, but the only one for which the dip is established is the Church Creek reverse fault (pl. 1), which was determined by Dickinson (1965) to dip 50°–80° NE. The much faulted area of sedimentary rocks in the southern part of the area

264-034 O—67——3

is basically a northwest-trending graben complicated by minor faults striking in diverse directions. One of these is the east-northeast-trending Willow Creek fault which, according to Dickinson (1965), underwent movement at least twice during the Tertiary.

The relative fault movement appears to be vertical. However, in this region of large scale strike-slip faulting, lateral movement on some of the faults in the primitive area is a possibility. The San Andreas fault to the northeast and the Sur-Nacimiento fault (Hill and Dibblee, 1953) 1 to 2 miles southwest of the primitive area probably have large lateral displacement, and Durham (1965) has presented evidence for 11 miles of strike-slip movement on a fault trending toward the primitive area from the southeast.

Most of the faults mapped in the primitive area have been recognized because they cut sedimentary rocks (fig. 5); many others probably exist in the metamorphic rocks. Fiedler (1944, p. 185) traced a few faults through the metamorphic rocks, "but only with the expenditure of much time and effort, and only where the faults had first been recognized in some sedimentary area."

The few faults that have been observed vary widely in the amount of deformation along them. The Church Creek and Miller Creek faults northeast of the primitive area are described by Dickinson (1965,

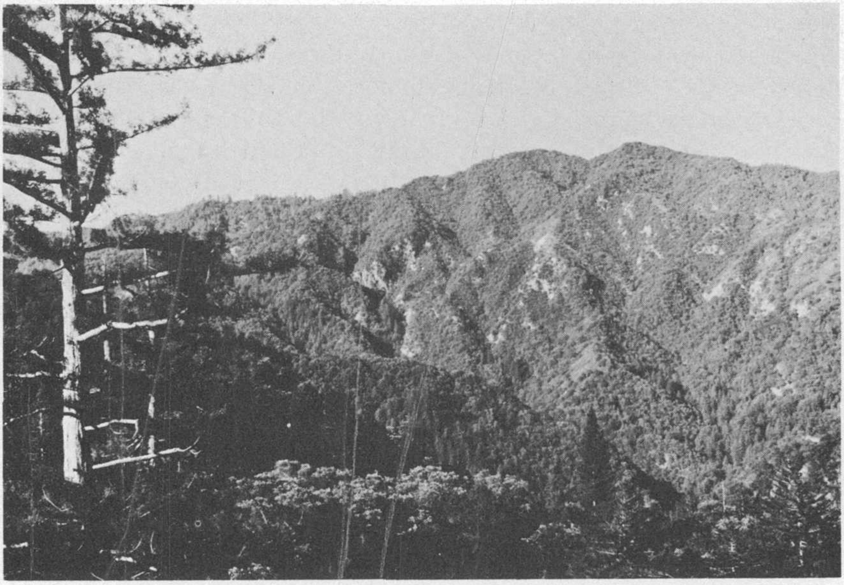

FIGURE 5.—Logwood Ridge viewed from northeast across junction of North and South Forks of Big Sur River. Left half of ridge top consists of Upper Cretaceous conglomerate in fault contact with Sur Series of Trask (1926) on right.

p. 40) as gouge zones that are less than a foot thick and have some shearing and gouge seams extending from 5 to 100 feet into the walls. Fiedler (1944, p. 231) described 150 feet of crushed and broken rock along the Palo Colorado fault (Redwood fault of Fiedler). The writer observed some fracturing near the larger faults, numerous narrow gouge seams and crushed zones in the metamorphic and granitic rocks, and one 25-foot-thick intensely sheared zone at the head of Skinner Creek. No evidence of mineralization was seen in any of these sheared rocks.

MINERAL RESOURCES

SETTING

Mineral resources have been exploited extensively in the southern Coast Ranges of California but none are known in the Ventana primitive area. Except for a trace of lead and zinc at one locality, no mineralization was noted along any of the faults, shear zones, or fractures that were examined, nor was any indication of significant metallic mineral deposits seen in any of the rocks or soils that were examined. Sediment samples were taken from the principal streams and tributaries that drain the area, and samples of bedrock units and altered rock were taken from fault zones and elsewhere. While a few contained traces of metals in anomalous amounts, all were below ore grade and none were indicative of significant deposits. No mineral production is known from any of the mining claims or prospects in the primitive area. It is unlikely that commercial quantities of oil and gas underlie the area.

Numerous mineral commodities have been obtained from various geologic environments in the Coast Ranges. The largest mercury mine in the United States lies about 50 miles north of the area, and the second largest is 50 miles east of the area. Smaller mercury mines lie a few tens of miles to the southeast. Oil and gas fields occupy sizable parts of the Coast Ranges from the latitude of Monterey Bay south to the Los Angeles area. Other mineral commodities known in the general region are diatomite, limestone, dolomite, manganese, chromite, and asbestos. Many of these mineral commodities, however, are in a geologic setting that differs markedly from that in the primitive area. Most mineral commodities are localized in certain kinds of geologic environments, as in rocks of a particular type or age, or in certain geologic structures. Where the localizing geologic factors are absent, the likelihood of finding deposits of a particular commodity is slight.

For example, the nearest producing oil field, the Salinas Valley field, lies about 10 miles east of the primitive area. As in most fields in the southern Coast Ranges, the oil is obtained from strata of middle to late Miocene age. Strata of this age are absent from the primitive area. Diatomite has also been produced mainly from strata of late Miocene age. Similarly, the mercury, chromite, manganese, and asbestos in the Coast Ranges have been found mostly in rocks of the Franciscan Formation or in associated intrusive rocks, mainly serpentinite. The Franciscan Formation is not present in the primitive area.

In the Coast Ranges mineral commodities that have been extracted from or are known in rocks similar to those of the primitive area are limestone, dolomite, and copper. In terms of past production dolomite is the most important of these. The largest dolomite quarries in California are in the northern Gabilan Range about 40 miles northeast of the primitive area (Jenkins, 1950). These bodies of dolomite are isolated remnants of metamorphic rocks that were intruded by granitic rocks; these metamorphic rocks have been correlated with the Sur Series of Trask (1926) exposed in the primitive area.

Limestone recrystallized to marble is present in sizable deposits in the narrow strip between the primitive area and the coast. To date these have been exploited on only a small scale.

Several occurrences of copper are known in the Gabilan and Santa Lucia Ranges outside the primitive area, but production from them has been negligible. The nearest of these to the primitive area and the only one known in the Santa Lucia Range is the Trampa Canyon prospect located about 4 miles east of the northeast corner of the primitive area. Fiedler (1944, p. 247) states that some ore has been mined from the prospect and that operations closed down about 1931. The property has been explored by several pits and adits whose small size indicates that if any ore was shipped the tonnage must have been very small. At the Trampa Canyon prospect the copper minerals are in tactite formed from marble at the contact with granodiorite. Though not well exposed, the body of tactite appears to be small and the copper content is low. Samples collected from the Trampa Canyon area were analysed spectrographically and chemically; the results are shown in table 1. Contacts of marble against granitic rocks, similar to the Trampa Canyon prospect, are present in the primitive area, but only very small amounts of tactite and mere traces of copper were seen along them.

Uranium, molybdenum, and mercury prospects exist in the vicinity of the primitive area but no significant deposits are known. Claims have been staked for the uranium in the Chews Ridge and Arroyo Seco areas, 1 to 3 miles east of the primitive area. However, the radioactivity is probably caused by the thorium content of the accessory monazite in granitic and metamorphic rocks (California Division of Mines, unpub. data). Molybdenite and possibly a trace of powellite have been reported in garnet-rich tactite from the vicinity of Jackhammer Spring on the Indians Road (California Division of Mines, unpub. data). Fiedler (1944, p. 248) reports a mercury prospect in silica-carbonate rock along the Blue Rock fault about 2 miles north of the primitive area.

The only mining claims known in the primitive area are on the east side of Island Mountain, which lies north of Big Sur River. Reiche (1937, p. 162) reports that prospecting was done in this area in the early 1930's in a "pyritized and hydrothermally altered shear-zone" along Big Sur River. According to Reiche, silver values reported in early assays from the zone were not confirmed by later assays. A prospect pit has been reported in this vicinity, but was not found by the writers during a traverse of Big Sur River. A gold prospect in pegmatite along the Little Sur River is mentioned by Fiedler (1944, p. 247), who states that the workings have been "blown up" and that no mineralized rock or ore was found at the site. The exact location is not described by Fiedler and was not found in this investigation. The only evidence of prospecting noted in the present survey is a small gravity concentrating rig and a small amount of digging in pegmatite on the east bank of the Arroyo Seco just outside the primitive area. This site is at the foot of a poor trail from Jackhammer Spring on the Indians Road. The work was done in the last few years. The pagmatite is not visibly mineralized; samples from it (table 1, samples P151a, P151b, and P151c) and from other pegmatites in the primitive area show no unusual concentrations of gold or other metals.

METHODS OF EVALUATION

The Ventana primitive area was investigated by visual examination of the rocks and by geochemical sampling. Foot traverses were made through as much of the area as was practicable (pl. 2). Samples of fine-grained stream sediments were collected near the mouths of most tributaries and at intervals of a mile or two along the trunk streams (pl. 2), and the pebble and boulder fraction was searched carefully for fragments of altered or mineralized rock. All the major rock types in the area were sampled in fresh or unaltered form, and samples were also taken of all rocks that showed evidence of alteration.

Most of the rock and stream-sediment samples were analyzed chemically and spectrographically for selected elements (table 1). Mercury and gold were determined by atomic absorption techniques. Samples were scanned with an ultraviolet lamp in search for fluorescent tungsten minerals; none were found.

TABLE 1.—*Analyses of samples from the*

[Parts per million, ppm; citrate

Sample	Semiquantitative spectrographic analyses (ppm)																	
	Ti	Mn	Ag	Ba	Be	Zr	Co	Cr	Cu	La	B	Mo	Ga	Nb	Sc	Ni	Pb	Sr
							Metamorphic rocks											
P1	2,000	500	<1	500	<1	--	10	70	50	50	--	<3	--	10	--	20	15	100
P2	200	100	<1	70	<1	--	<3	20	7	<30	--	15	--	<10	--	<3	<10	3,000
P14	10,000	2,000	<1	100	<1	--	30	30	70	30	--	<3	--	10	--	30	<10	300
P18	2,000	70	<1	100	<1	--	<3	10	7	<30	--	<3	--	<10	--	5	<10	20
P30	1,500	300	<1	1,000	<1	--	5	10	20	<30	--	<3	--	<10	--	10	<10	200
P33	7,000	1,000	<1	1,500	<1	--	30	70	20	<30	--	<3	--	<10	--	30	<10	100
P37	700	50	<1	150	<1	--	3	5	7	<30	--	<3	--	<10	--	3	<10	20
P38	15,000	1,000	<1	200	<1	--	50	700	70	30	--	<3	--	15	--	200	<10	300
P39	3,000	150	<1	500	<1	--	15	30	50	30	--	<3	--	10	--	20	<10	50
P51	3,000	300	<.5	70	1	100	<5	20	20	20	<10	<2	<10	--	5	5	<10	<50
P61	5,000	300	<.5	100	1	150	5	100	100	30	100	<2	10	--	10	30	15	1,000
P92	700	300	<.5	70	<1	30	<5	50	7	<20	<10	<2	<10	--	<5	30	10	700
P97	10,000	200	<.5	1,000	<1	100	10	50	30	70	<10	<2	50	--	20	7	20	500
P98	1,500	700	<.5	20	<1	<10	50	1,500	30	<20	<10	<2	15	--	30	100	<10	200
P105	150	70	<.5	1,000	<1	<10	<5	5	<2	<20	100	<2	<10	--	<5	3	<10	300
P133	200	700	<.5	<10	<1	<10	100	3,000	3	<20	15	<2	<10	--	7	5,000	<10	<50
P153	10,000	2,000	<.5	150	<1	200	100	200	70	<20	<10	<2	30	--	30	50	<10	200
P154	7,000	300	<.5	>5,000	<1	300	5	150	20	30	<10	<2	20	--	15	30	20	300
P188b	7,000	1,500	<.5	70	2	50	100	700	30	<20	10	<2	20	--	30	100	<10	300
P194	7,000	700	<.5	1,000	2	300	10	70	30	<20	<10	<2	20	--	20	7	15	1,000
P217	5,000	1,000	<.5	700	1	100	50	150	50	70	10	<2	70	--	30	50	20	70
P219	1,000	70	<.5	1,000	1	150	<5	20	30	20	<10	<2	<10	--	<5	7	20	50
P221	>10,000	2,000	<.5	700	2	300	30	300	50	50	<10	<2	30	--	30	70	20	500
P223	150	1,500	<.5	<10	<1	<10	70	2,000	10	<20	<10	<2	30	--	7	1,500	<10	<50
P227	5,000	3,000	<.5	70	<1	150	5	50	3	20	10	<2	20	--	7	30	<10	70
P232	7,000	200	<.5	1,500	2	500	10	70	30	150	<10	<2	30	--	7	70	20	300
P234	1,000	700	<.5	70	1	70	5	150	7	20	10	<2	10	--	7	30	10	5,000
P235	1,500	50	<.5	300	1	200	<5	20	30	<20	<10	<2	<10	--	<5	7	20	<50
P268	5,000	200	<.5	50	<1	150	<5	200	70	20	<10	<2	<10	--	5	20	<10	50
P273	5,000	100	<.5	500	<1	200	<5	200	100	20	15	<2	<10	--	10	20	<10	100
P275	7,000	100	<.5	2,000	<1	100	<5	200	30	30	10	500	15	--	20	10	20	1,000
P276b	5,000	200	<.5	70	<1	150	<5	100	100	20	10	150	<10	--	15	300	<10	50
P277a	5,000	150	<.5	1,500	<1	200	<5	100	200	100	10	200	10	--	20	100	<10	200
H32	>10,000	1,500	<.5	150	1	100	70	700	100	20	10	<2	20	--	30	70	10	300
H42a	300	10	<.5	70	<1	15	<5	30	<2	<20	<10	<2	<10	--	<5	2	<10	1,500
H46	500	70	<.5	1,000	1	50	<5	5	50	<20	<10	<2	20	--	<5	5	30	700
H71	2,000	300	<.5	1,500	1	300	<5	7	7	50	<10	<2	15	--	<5	2	30	500
H72	5,000	300	<.5	300	1	150	<50	30	30	20	<10	<2	10	--	7	7	15	150
H78	5,000	1,500	<.5	10	1	100	100	150	5	<20	<10	<2	10	--	50	200	<10	500
H135b	500	50	<.5	70	1	700	<5	10	50	<20	<10	<2	<10	--	15	3	<10	<50
							Intrusive rocks											
P6	3,000	300	<1	1,500	1.5	--	5	7	5	70	--	<3	--	10	--	<3	15	500
P15a	5,000	700	<1	700	1	--	15	50	15	30	--	<3	--	<10	--	15	<10	300
P15b	10,000	300	<1	700	1	150	30	100	30	<20	<10	<2	20	--	10	30	15	300
P15c	10,000	300	<1	700	1	200	50	150	70	<20	<10	<2	20	--	15	30	20	300
P34	200	1,000	<1	200	<1	--	3	7	7	30	--	<3	--	<10	--	7	<10	70
P42	10,000	700	<.5	200	<1	30	50	500	30	<20	<10	<2	30	--	30	30	<10	1,500
P43	--	--	<.1	150	<1	50	70	1,000	200	<30	<30	<3	10	<3	50	150	15	200
P45	1,500	100	<.5	1,500	1.5	150	<5	<5	10	50	<10	<2	30	--	<5	<2	50	1,000
P47	10,000	1,000	<.5	1,000	1	150	20	70	10	50	<10	<2	30	--	20	7	10	1,000
P48a	70	20	<1	70	<1	--	<3	1	20	<30	--	<3	--	<10	--	<3	<10	<5
P48b	50	20	<1	300	<1	--	<3	1	7	<30	--	<3	--	<10	--	<3	<10	30
P82	--	--	<.1	1,000	2	300	15	70	15	70	<30	<3	15	7	15	<30	15	500
P94	--	--	<.1	1,500	1	200	10	50	10	70	<30	<3	15	10	20	<30	30	500
P95	3,000	150	<.5	3,000	<1	70	<5	7	30	70	<10	<2	20	--	<5	7	50	2,000
P100	<20	300	<.5	<10	<1	<10	100	3,000	2	<20	15	<2	<10	--	7	3,000	<10	<50

Ventana primitive area, Monterey County, Calif.

soluble heavy metals test, cxHM]

	Semiquantitative spectrographic analyses--Continued (ppm)			(percent)			Chemical analyses (ppm)			
Sample	V	Y	Zn	Fe	Mg	Ca	Hg	Au	cxHM	Sample description
					Metamorphic rocks					
P1	150	20	<200	3.0	1.5	0.7	0.025	<0.1	--	Graphitic schist.
P2	10	<10	<200	.3	.3	>10	<.010	<.1	--	Graphitic marble.
P14	500	50	<200	>10	5	7	.030	<.1	--	Amphibolite.
P18	20	<10	<200	1	.3	.15	.015	<.1	--	Cordierite(?)-bearing gneiss.
P30	30	10	<200	1.5	1	1	<.010	<.1	--	Quartz-feldspar gneiss.
P33	300	30	<200	7	3	7	<.010	<.1	--	Amphibolite.
P37	10	<10	<200	.7	.15	.07	<.010	<.1	--	Quartzite.
P38	500	30	<200	7	7	7	.025	<.1	--	Amphibolite.
P39	70	10	<200	3	1	.15	<.010	<.1	--	Migmatitic mica schist.
P51	20	5	<200	2	.2	.7	.150	<.1	--	Quartzite.
P61	50	15	<200	3	2	10	.130	<.1	--	Calc-silicate gneiss.
P92	100	7	<200	1	5	>20	.010	<.1	--	Graphitic marble.
P97	50	20	<200	7	2	3	<.010	<.1	--	Biotite-quartz-feldspar gneiss.
P98	100	7	<200	5	7	10	.030	<.1	--	Amphibolite.
P105	50	<5	<200	.1	7	>20	.030	<.1	--	Graphitic marble, float.
P133	15	<5	<200	7	10	.5	.070	<.1	--	Mafic dike.
P153	200	20	<200	15	7	15	.100	<.1	--	Biotite amphibolite.
P154	150	20	<200	5	3	1	.060	<.1	--	Biotite-quartz-feldspar gneiss.
P188b	200	15	<200	10	5	10	<.010	.2	--	Amphibolite.
P194	100	30	<200	7	3	10	.080	<.1	--	Biotite-hornblende orthogneiss.
P217	50	30	<200	7	2	.3	.030	<.1	--	Garnet-sillimanite schist.
P219	15	<5	<200	1	.5	.3	.020	.2	--	Quartzite.
P221	100	20	<200	10	10	7	.070	<.1	--	Garnet mica schist.
P223	15	7	<200	3	10	7	<.010	<.1	--	Calc-silicate rock.
P227	70	10	<200	7	1.5	15	.020	<.1	--	Garnet diopside rock, float.
P232	70	15	<200	5	2	3	.320	<.1	--	Biotite-quartz-feldspar gneiss.
P234	20	7	<200	3	1.5	>20	<.010	.2	--	Calc-silicate rock.
P235	10	5	<200	1.5	.7	.1	.010	.3	--	Quartzite.
P268	300	20	<200	5	1	2	--	--	--	Sulfidic graphitic gneiss.
P273	200	15	<200	3	1	1.5	--	--	--	Do.
P275	5,000	30	<200	2	.5	2	--	--	--	Do.
P276b	500	20	300	5	.5	2	--	--	--	Do.
P277a	500	20	<200	5	1	2	--	--	--	Do.
H32	150	10	<200	10	5	10	<.010	.2	--	Biotite amphibolite.
H42a	10	<5	<200	.5	3	>20	.030	<.1	--	Graphitic marble.
H46	10	<5	<200	.7	.5	2	.080	<.1	--	Quartz-feldspar schist.
H71	15	7	<200	2	.7	1	.080	<.1	--	Feldspathic quartzite.
H72	30	15	<200	3	1	1.5	.020	<.1	--	Do.
H78	150	30	<200	10	5	10	.020	<.1	--	Amphibolite.
H135b	10	5	<200	.7	.2	.07	.150	<.1	--	Quartzite.
					Intrusive rocks					
P6	70	15	<200	2	.7	1	.015	<.1	--	Porphyritic quartz monzonite.
P15a	200	30	<200	5	1.5	3.0	<.010	.5	--	Foliated quartz diorite.
P15b	150	15	<200	10	3	1.5	.020	<.1	--	Do.
P15c	150	10	<200	7	2	1.5	.020	<.1	--	Do.
P34	<7	30	<200	2	.3	.3	<.010	<.1	--	Leucogranite.
P42	150	10	<200	7	7	15	.030	<.1	--	Hornblende diorite.
P43	100	10	<100	--	--	--	--	--	--	Hornblendite.
P45	10	7	<200	.7	.3	2	.050	<.1	--	Graphic pegmatite.
P47	70	15	<200	7	3	7	.080	<.1	--	Granodiorite.
P48a	<7	<10	<200	.02	.01	.015	--	<.1	--	Quartz core of pegmatite.
P48b	<7	<10	<200	.03	.01	.1	--	<.1	--	Do.
P82	70	30	<100	--	--	--	--	--	--	Granodiorite.
P94	70	30	<100	--	--	--	--	--	--	Quartz diorite.
P95	20	5	<200	1.5	.7	.7	.040	<.1	--	Pegmatoid quartz monzonite.
P100	15	<5	<200	7	10	.05	.170	.1	--	Serpentinite.

TABLE 1.—*Analyses of samples from the Ventana*

[Parts per million, ppm ; citrate

	Semiquantitative spectrographic analyses (ppm)																	
Sample	Ti	Mn	Ag	Ba	Be	Zr	Co	Cr	Cu	La	B	Mo	Ga	Nb	Sc	Ni	Pb	Sr
Intrusive rocks--Continued																		
P129	100	300	<0.5	1,500	<1	10	<5	<5	7	20	<10	<2	15	--	<5	2	70	150
P134	10,000	300	<.5	500	1.5	100	20	20	7	150	<10	<2	30	--	15	20	<10	300
P135	--	--	<.1	1,000	1	300	10	30	7	70	<30	<3	15	7	15	<30	20	500
P144	--	--	<.1	100	<1	10	50	100	70	<30	<30	<3	15	<3	50	<30	10	300
P151a	1,000	150	<.5	1,000	1	20	<5	5	15	20	<10	<2	20	--	<5	2	100	700
P151b	700	200	<.5	200	3	70	<5	<5	20	<20	<10	<2	15	--	5	3	50	200
P151c	300	100	<.5	1,000	1	50	<5	15	50	20	<10	<2	30	--	<5	3	150	700
P186	70	2,000	<.5	1,000	1	150	<5	20	30	20	10	<2	15	--	10	20	70	300
P222	--	--	<.1	1,500	<1	150	<1	<3	2	30	<30	<3	15	<3	<1	<30	70	200
P290	1,000	200	<.5	200	<1	<10	<5	70	5	<20	<10	<2	<10	--	<5	15	<10	1,000
H4	300	150	<.5	700	1	20	<5	70	10	<20	<10	<2	10	--	<5	30	50	300
H5	10,000	700	<.5	1,500	<1	150	20	100	7	50	<10	<2	20	--	15	5	15	1,500
H6	7,000	700	<.5	100	2	200	7	30	30	20	<10	<2	20	--	15	5	15	300
H7	>10,000	1,500	<.5	1,500	<1	100	70	20	30	50	<10	<2	20	--	30	7	15	2,000
H14a	1,500	1,000	<.5	20	<1	10	100	3,000	100	<20	30	<2	<10	--	15	700	<10	<50
H23	100	2,000	<.5	20	<1	<10	100	>5,000	2	<20	10	<2	<10	--	5	3,000	<10	50
H24	500	70	<.5	>5,000	1	70	<5	150	5	100	<10	<2	20	--	<5	7	70	1,500
H28	5,000	100	<.5	2,000	3	300	<5	<5	20	70	10	<2	30	--	5	3	30	500
H38b	150	300	<.5	<10	<1	<10	70	3,000	10	<20	10	<2	<10	--	<5	3,000	<10	100
H39	--	--	<.1	1,500	1	200	3	7	3	30	<30	<3	15	7	<1	<30	30	300
H40	150	100	<.5	150	1	<10	<5	5	30	20	<10	<2	<10	--	<5	3	15	50
H49	200	150	<.5	500	3	>1,000	<5	15	7	20	<10	<2	15	--	<5	3	10	500
H54	2,000	150	<.5	700	1	20	<5	5	7	50	<10	<2	15	--	5	3	70	300
H58	150	500	<.5	<10	<1	<10	100	2,000	7	<20	70	<2	<10	--	7	3,000	<10	<50
H69	5,000	1,000	<.5	500	1	150	50	50	15	<20	<10	<2	20	--	30	10	10	700
H76	--	--	<.1	1,500	1	150	3	<3	7	70	<30	<3	10	5	5	<30	50	300
H77	150	700	<.5	10	<1	<10	100	3,000	15	<20	<10	<2	<10	--	7	2,000	<10	<50
H135a	--	--	<.1	150	<1	20	20	500	50	<30	<30	<3	15	<3	30	100	10	200
H138	300	1,000	<.5	<10	1	<10	100	3,000	5	<20	<10	<2	<10	--	7	3,000	<10	<50
H139	100	1,500	<.5	700	2	30	<5	<5	50	<20	<10	<2	20	--	5	3	50	300
H147	700	150	<.5	300	1.5	15	<5	<5	7	<20	<10	<2	30	--	<5	20	150	150
H159	300	300	<.5	<10	<1	<10	150	3,000	7	<20	70	<2	50	--	7	3,000	<10	<50
H161	3,000	1,500	<.5	15	<1	15	150	3,000	150	<20	10	<2	<10	--	50	300	<10	50
H162	300	70	<.5	700	1	100	<5	<5	20	30	<10	<2	15	--	<5	3	70	300
H173	1,500	300	<.5	150	7	70	10	20	70	300	15	<2	15	--	15	15	30	300
H174	300	300	<.5	150	1	70	<5	<5	30	30	<10	<2	15	--	<5	2	50	100
H180	1,500	300	<.5	700	2	300	<5	5	20	30	10	<2	30	--	7	2	30	100
H185	--	--	<.1	1,500	2	200	<1	5	5	30	<30	<3	20	5	5	<30	20	150
Sedimentary rocks																		
P23	3,000	500	<1	500	2	--	15	150	70	50	--	<3	--	10	--	70	15	150
P24	2,000	500	<1	500	<1	--	7	50	7	50	--	<3	--	10	--	20	10	100
P25	3,000	1,000	<1	500	1.5	--	20	100	50	50	--	<3	--	10	--	70	15	150
P26a	2,000	500	<1	700	1.5	--	7	50	7	30	--	<3	--	10	--	20	10	200
P26b	3,000	500	<1	500	1.5	--	7	50	10	30	--	<3	--	10	--	30	10	200
P90	3,000	300	<1	700	1	--	10	50	30	50	--	<3	--	<10	--	15	10	200
P125	5,000	300	<.5	1,500	<1	100	7	150	20	50	<10	<2	30	--	10	7	20	1,500
P174	1,000	300	<.5	1,000	<1	30	<5	150	3	20	<10	<2	<10	--	5	3	10	700
P185	1,500	150	<.5	300	<1	100	<5	15	50	<20	<10	<2	10	--	<5	<2	30	<50
P191a	300	150	<.5	700	1	70	<5	5	30	<20	<10	<2	<10	--	<5	5	20	50
P192	7,000	150	<.5	1,000	1	200	7	150	30	70	70	<2	70	--	30	20	50	300
P242	7,000	150	<.5	700	3	150	5	70	20	50	70	<2	30	--	15	20	50	150
H18a	500	100	<1	2,000	<1	--	<3	5	10	<30	--	<3	--	<10	--	<3	10	150
H18b	1,000	200	<1	700	<1	--	3	10	10	30	--	<3	--	<10	--	3	10	100
H26	3,000	500	<1	500	<1	--	15	150	30	<30	--	<3	--	<10	--	50	<10	100

primitive area, Monterey County, Calif.—Continued

soluble heavy metals test, cxHM]

Sample	Semiquantitative spectrographic analyses--Continued (ppm)			(percent)			Chemical analyses (ppm)			Sample description
	V	Y	Zn	Fe	Mg	Ca	Hg	Au	cxHM	
					Intrusive rocks--Continued					
P129	10	7	<200	1	.15	--	0.010	<0.1	--	Pegmatite.
P134	70	15	<200	10	2	2	.020	<.1	--	Quartz diorite.
P135	70	30	<100	--	--	--	--	--	--	Granodiorite.
P144	500	15	<100	--	--	--	--	--	--	Hornblende gabbro.
P151a	10	7	<200	.7	.7	1	.620	<.1	--	Pegmatite.
P151b	10	10	<200	1.5	.7	1	.230	<.1	--	Pegmatite.
P151c	10	15	<200	1	.5	2	.120	<.1	--	Do.
P186	10	5	<200	2	.5	1	.040	<.1	--	Garnetiferous alaskite.
P222	<1	15	<100	--	--	--	--	--	--	Pegmatoid granite.
P290	30	10	<200	1.5	1	10	--	--	--	Green-stained granite.
H4	<10	<5	<200	1	.7	1	.120	<.1	--	Biotite quartz monzonite.
H5	70	15	<200	7	3	10	.030	.2	--	Granodiorite.
H6	50	15	<200	5	1.5	3	.020	<.1	--	Foliated granodiorite.
H7	150	15	<200	10	7	15	.100	<.1	--	Gabbro.
H14a	30	5	<200	15	10	1	.040	<.1	--	Peridotite.
H23	20	<5	<200	.7	10	.2	.200	<.1	--	Serpentinite, float.
H24	10	7	<200	.5	.7	2	.010	.1	--	Pegmatite, float.
H28	20	10	<200	3	.7	.5	.020	<.1	--	Leucogranite.
H38b	<10	<5	<200	3	7	15	.070	<.1	--	Serpentinite, float.
H39	10	10	<100	--	--	--	--	--	--	Biotite granite.
H40	<10	7	<200	.15	.15	.2	<.010	<.1	--	Pegmatite.
H49	<10	10	300	.7	.5	1	.020	<.1	--	Do.
H54	15	70	<200	2	.7	1	<.010	<.1	--	Do.
H58	15	<5	<200	7	10	2	.030	<.1	--	Serpentinite.
H69	150	5	<200	10	3	7	.010	<.1	--	Quartz diorite.
H76	7	30	<100	--	--	--	--	--	--	Garnetiferous biotite granite.
H77	30	<5	<200	7	10	2	.010	<.1	--	Peridotite.
H135a	100	15	<100	--	--	--	--	--	--	Gabbro.
H138	15	15	<200	10	10	15	.070	<.1	--	Peridotite.
H139	<10	30	<200	1.5	.15	.7	.070	<.1	--	Granite.
H147	<10	7	<200	.7	.7	.7	.050	<.1	--	Pegmatite.
H159	15	<5	<200	10	>10	.07	.100	<.1	--	Serpentinite.
H161	70	7	<200	15	10	15	.100	.2	--	Peridotite.
H162	<10	5	<200	1	.2	.7	.020	<.1	--	Pegmatite.
H173	30	30	<200	3	2	5	.100	<.1	--	Pegmatite, float.
H174	<10	15	<200	1	.15	.7	.010	.3	--	Pegmatite.
H180	10	15	<200	3	.7	1	.050	.5	--	Granodiorite.
H185	<1	20	<100	--	--	--	--	--	--	Quartz monzonite.
					Sedimentary rocks					
P23	150	30	<200	5	2	.7	.015	<.1	--	Gray sandy siltstone.
P24	30	15	<200	2	.7	.1	.015	<.1	--	Sandstone.
P25	150	30	<200	5	1.5	.5	.025	<.1	--	Do.
P26a	70	20	<200	3	1.5	.5	<.010	<.1	--	Conglomerate matrix.
P26b	100	15	<200	3	2	.5	<.010	<.1	--	Do.
P90	100	15	<200	3	1.5	.3	--	<.1	--	Do.
P125	50	20	<200	5	2	5	.030	<.1	--	Do.
P174	10	7	<200	3	7	20	.050	<.1	--	Do.
P185	15	<5	<200	1.5	.1	.15	<.010	<.1	--	Sandstone.
P191a	10	5	<200	.7	.15	.07	<.010	<.1	--	Do.
P192	150	15	<200	7	2	1	.100	<.1	--	Light-gray siltstone.
P242	70	15	<200	5	2	.7	.050	<.1	--	Gray claystone.
H18a	15	<10	<200	.7	.7	.1	--	<.1	--	Sandstone.
H18b	15	10	<200	1	.5	.2	--	<.1	--	Conglomerate matrix.
H26	150	20	<200	5	2	.7	--	<.1	--	Do.

TABLE 1.—*Analyses of samples from the Ventana*

[Parts per million, ppm ; citrate

Sample	Semiquantitative spectrographic analyses (ppm)																	
	Ti	Mn	Ag	Ba	Be	Zr	Co	Cr	Cu	La	B	Mo	Ga	Nb	Sc	Ni	Pb	Sr
Sedimentary rocks--Continued																		
H27	1,000	1,500	<0.5	1,500	2	300	50	300	30	50	50	<2	30	--	30	70	30	700
H31	2,000	300	<1	1,000	<1	--	10	50	20	<30	--	<3	--	10	--	15	10	100
H61	>10,000	300	<.5	700	<1	300	<5	30	70	150	<10	<2	15	--	15	3	20	150
H62	7,000	1,000	<.5	1,500	2	150	15	150	7	30	<10	<2	20	--	15	30	30	300
H63	7,000	300	<.5	1,000	<1	100	10	500	70	50	15	<2	30	--	20	70	20	1,000
H66	>10,000	1,500	<.5	1,000	<1	100	20	150	70	20	<10	<2	20	--	20	30	15	500
H68	7,000	1,500	<.5	2,000	<1	70	<5	100	30	30	<10	<2	30	--	15	7	50	700
H80	3,000	150	<.5	1,500	1	150	<5	15	5	70	<10	<2	10	--	7	<2	30	300
H95	7,000	300	<.5	1,500	1	150	5	150	30	30	<10	<2	30	--	15	7	20	300
H116	5,000	100	<.5	3,000	1	70	<5	5	7	30	<10	<2	20	--	<5	<2	50	1,000
H126	7,000	300	<.5	1,500	2	300	5	30	50	30	20	<2	30	--	10	3	20	300
H148	5,000	300	<.5	1,500	1	50	<5	15	50	50	<10	<2	15	--	7	5	20	300
H150	10,000	2,000	<.5	700	2	150	70	50	30	50	30	<2	30	--	15	70	30	300
H151	5,000	150	<.5	1,500	2	100	<5	10	30	30	<10	<2	15	--	<5	2	20	150
H168	5,000	100	<.5	200	2	200	<5	50	30	50	10	<2	10	--	7	20	15	<50
Altered rocks																		
P3a	1,500	150	<1	1,000	1.5	--	3	30	20	50	--	5	--	<10	--	7	10	200
P3b	1,500	200	<1	150	1	--	<3	20	3	30	--	<3	--	10	--	<3	10	30
P5	3,000	700	<1	1,000	1	--	15	50	30	50	--	<3	--	<10	--	15	10	500
P7	1,000	150	<1	700	1	--	5	3	50	30	--	7	--	<10	--	<3	30	200
P12b	5,000	300	<1	500	<1	--	<3	70	70	50	--	7	--	30	--	<3	<10	200
P16a	500	30	3	20	<1	--	150	3	1,500	<30	--	7	--	<10	--	200	<10	20
P16b	5,000	500	<.5	100	1	1,000	<5	100	10	150	<10	<2	10	--	10	5	15	1,000
P17	3,000	1,000	<1	30	1.5	--	7	30	50	30	--	<3	--	10	--	20	<10	70
P19	5,000	300	<1	2,000	1.5	--	10	150	50	70	--	5	--	10	--	30	30	200
P21b	1,500	700	<1	100	1.5	--	15	30	150	<30	--	<5	--	10	--	30	<10	30
P21c	5,000	150	<1	1,500	1.5	--	7	2	50	50	--	<3	--	10	--	<3	20	200
P22a	1,000	300	<1	70	<1	--	3	20	10	30	--	<3	--	<10	--	7	<10	100
P22b	2,000	300	<1	30	<1	--	5	30	10	30	--	<3	--	10	--	10	<10	150
P28	700	100	<1	100	<1	--	<3	10	7	<30	--	<3	--	<10	--	3	<10	10
P29	700	15	<1	200	<1	--	15	15	300	<30	--	<7	--	<10	--	15	<10	7
P32	5,000	500	<1	700	<1	--	15	150	70	50	--	<3	--	10	--	50	10	500
P35	1,500	200	<1	2,000	<1	--	<3	7	3	50	--	<3	--	<10	--	<3	20	300
P46	10,000	1,500	<.5	1,500	1	100	15	70	7	30	<10	<2	50	--	20	7	30	1,000
P50	700	700	<1	200	1	--	15	30	150	<30	--	<5	--	<10	--	30	15	30
P52a	1,500	300	<1	1,000	1	--	<3	2	3	70	--	<3	--	<10	--	<3	10	150
P52b	5,000	1,000	<1	500	1	--	10	15	7	30	--	<3	--	<10	--	<3	10	20
P54	5,000	1,500	<1	200	1	--	10	300	7	50	--	<5	--	10	--	15	<10	100
P60	5,000	1,000	<1	700	<1	--	10	100	50	150	--	<3	--	30	--	10	10	200
P78b	1,000	500	<1	1,000	1.5	--	3	1	5	<30	--	<3	--	<10	--	<3	10	70
P78c	1,000	150	<1	1,500	<1	--	<3	1	7	<30	--	<3	--	<10	--	<3	10	150
P78d	3,000	700	<1	1,000	1.5	--	3	1.5	2	70	--	<3	--	15	--	<3	<10	150
P83	50	150	<1	15	<1	--	<3	3	30	<30	--	<3	--	<10	--	<3	<10	300
P84	3,000	3,000	<.5	200	1	100	<5	70	15	70	15	<2	10	--	15	7	30	300
P85a	3,000	500	<1	2,000	1.5	--	15	100	50	70	--	<3	--	30	--	30	<10	200
P85b	2,000	300	<1	2,000	1.5	--	15	50	300	30	--	<3	--	<10	--	20	<10	150
P85c	5,000	1,500	<1	300	<1	--	15	100	70	<30	--	3	--	<10	--	15	<10	30
P85d	7,000	1,000	<1	1,000	3	--	7	50	50	100	--	<3	--	100	--	10	<10	200
P87a	>10,000	3,000	<.5	300	2	150	70	1,500	50	30	50	<2	20	--	30	100	20	200
P87b	>10,000	3,000	<.5	1,500	1	150	70	2,000	150	30	150	<2	20	--	50	150	<10	300
P87c	3,000	300	<1	500	1	--	5	30	100	<30	--	<3	--	<10	--	20	15	30
P87d	10,000	700	<1	150	<1	--	50	70	70	<30	--	<3	--	<10	--	30	<10	200
P88	>10,000	2,000	<.5	300	<1	150	100	20	300	100	10	<2	20	--	30	30	<10	1,500
P89	7,000	1,000	<1	150	<1	--	15	15	20	70	--	<3	--	30	--	10	<10	150
P91	10,000	300	<.5	500	3	500	30	150	70	50	10	<2	15	--	15	30	30	150
P96	3,000	500	<1	500	1	--	15	20	300	50	--	<3	--	<10	--	5	<10	150

primitive area, Monterey County, Calif.—Continued

soluble heavy metals test, cxHM]

	Semiquantitative spectrographic analyses--Continued (ppm)			(percent)			Chemical analyses (ppm)			
Sample	V	Y	Zn	Fe	Mg	Ca	Hg	Au	cxHM	Sample description
						Sedimentary rocks--Continued				
H27	150	20	<200	10	5	7	0.140	<0.1	--	Siltstone.
H31	100	15	<200	3	1	.15	--	<.1	--	Conglomerate matrix.
H61	20	15	<200	3	.5	15	.125	<.1	--	Do.
H62	30	7	<200	3	2	.7	<.010	<.1	--	Arkosic sandstone.
H63	70	15	<200	7	3	5	.080	<.1	--	Nodular shale.
H66	100	15	<200	7	3	7	.030	<.1	--	Graywacke.
H68	50	15	<200	3	1.5	7	.090	<.1	--	Arkose.
H80	20	15	<200	1.5	1.5	15	<.010	<.1	--	Sandstone.
H95	70	15	<200	5	2	1.5	.350	<.1	--	Do.
H116	15	7	<200	1	.5	1	.110	<.1	--	Do.
H126	50	20	<200	7	1.5	.7	.030	<.1	--	Conglomerate matrix.
H148	30	10	<200	3	.7	1	.200	<.1	--	Sandstone.
H150	70	30	<200	7	2	1.5	.200	<.1	--	Argillaceous siltstone.
H151	20	7	<200	2	.5	.5	.060	<.1	--	Conglomerate matrix.
H168	30	10	<200	2	.7	.05	<.010	<.1	--	Do.
						Altered rocks				
P3a	30	15	<200	1.5	.3	1.0	.030	<.1	--	FeO-stained granite, float.
P3b	20	20	<200	1.0	.15	.3	.030	<.1	--	Do.
P5	200	30	<200	5.0	2.0	>10	.030	<.1	--	Pyritic quartzite, float.
P7	70	20	<200	7	.3	.3	.030	<.1	--	Limonite from fracture.
P12b	150	30	<200	>10	1.5	1.0	--	<.1	--	Altered rock, float.
P16a	<7	<10	<200	>10	.015	.7	.050	<.1	--	Pyritic calc-silicate.
P16b	15	30	<200	3	2	20	<.010	<.1	--	Do.
P17	30	30	<200	3	.7	1	.015	<.1	--	FeO-stained quartzite.
P19	200	20	<200	7	1.5	.5	.025	<.1	--	Sheared granitic rock.
P21b	50	70	<200	7	.7	.1	.025	<.1	--	Altered rock float.
P21c	150	20	<200	5	.5	1	.060	<.1	--	Altered granitic rock.
P22a	30	10	<200	1.5	.7	>10	<.010	<.1	--	Calc-silicate rock.
P22b	30	20	<200	2	1.5	>10	<.010	<.1	--	Do.
P28	15	<10	<200	.7	.07	.05	.015	<.1	--	Quartz vein.
P29	70	<10	<200	>10	.01	.02	.025	<.1	--	Limonite from quartz vein.
P32	150	20	<200	5	2	7	.030	<.1	--	Sulfide-bearing gneiss float.
P35	30	15	<200	2	.7	.3	.015	<.1	--	FeO-stained granite, float.
P46	150	10	<200	10	5	7	<.010	<.1	--	Sheared granitic rock.
P50	20	10	<200	>10	.15	.2	--	<.1	--	Limonite, joints in quartzite.
P52a	20	15	<200	3	.5	.7	--	<.1	--	Brown fault breccia.
P52b	100	50	<200	5	1.5	2	--	<.1	--	Gray fault breccia.
P54	100	20	200	>10	2	.5	--	<.1	--	Limonite, joints in granite.
P60	150	30	<200	7	2	1.5	--	<.1	--	Garnet-biotite gneiss.
P78b	15	10	<200	5	.2	.2	--	<.1	--	Altered rock, float.
P78c	10	10	<200	2	.2	.3	--	<.1	--	Do.
P78d	20	70	<200	7	1.5	.7	--	<.1	--	Do.
P83	<7	<10	<200	.2	1.5	>10	--	<.1	--	Silica-carbonate rock, float.
P84	20	15	<200	2	2	>20	.060	<.1	--	Calcite veinlets in mudstone.
P85a	150	20	<200	7	1.5	.3	--	<.1	--	FeO-stained float.
P85b	100	15	<200	7	1	.3	--	<.1	--	Do.
P85c	200	20	<200	>10	1.5	1	--	<.1	--	Do.
P85d	150	70	<200	7	2	3	--	<.1	--	Do.
P87a	200	20	<200	15	3	15	.120	<.1	--	Brown sandstone, float.
P87b	150	15	<200	15	7	15	.050	<.1	--	Amphibolite, float.
P87c	200	15	<200	5	1.5	.1	--	<.1	--	Mineralized rock, float.
P87d	500	30	<200	>10	.5	2	--	<.1	--	Sandstone, float.
P88	200	15	<200	15	5	15	1.500	.1	--	Calc-silicate rock, float.
P89	200	20	<200	7	1	.5	--	<.1	--	Altered rock, float.
P91	70	20	<200	5	1.5	10	.150	<.1	--	Calc-silicate gneiss, float.
P96	100	20	<200	5	1.5	.5	--	<.1	--	Gouge.

TABLE 1.—*Analyses of samples from the Ventana*

[Parts per million, ppm; citrate

	Semiquantitative spectrographic analyses (ppm)																	
Sample	Ti	Mn	Ag	Ba	Be	Zr	Co	Cr	Cu	La	B	Mo	Ga	Nb	Sc	Ni	Pb	Sr
								Altered rocks--Continued										
P99	700	70	<1	70	<1	--	15	15	20	<30	--	15	--	<10	--	<3	<10	10
P101a	7,000	150	1.5	3,000	1	300	<5	70	30	20	10	<2	15	--	15	7	100	70
P101b	3,000	150	<.5	70	1	200	<5	15	15	<20	<10	<2	<10	--	5	20	10	<50
P102b	3,000	100	<.5	1,500	2	200	<5	<5	20	50	<10	<2	20	--	<5	5	20	300
P103b	5,000	300	<.5	2,000	1	200	<5	50	10	50	<10	<2	50	--	7	7	20	500
P104	1,000	70	<.5	700	2	300	<5	30	10	50	<10	<2	15	--	10	5	30	50
P106	2,000	150	<.5	700	1	70	<5	5	30	20	<10	<2	10	--	<5	5	50	100
P110a	7,000	300	<.5	1,500	2	70	20	100	100	20	30	30	30	--	30	30	20	500
P110b	1,000	30	<.5	>5,000	<1	30	<5	20	50	<20	<10	7	30	--	<5	3	30	1,500
P110c	700	100	<.5	>5,000	1	30	20	30	20	<20	<10	10	20	--	<5	20	50	30
P117b	10,000	300	<.5	70	1.5	150	20	150	30	30	<10	<2	20	--	20	30	15	300
P118b	>10,000	300	<.5	1,500	<1	300	70	1,000	50	70	70	<2	70	--	50	150	20	2,000
P121a	3,000	100	<.5	300	2	200	<5	20	150	30	70	5	15	--	5	2	50	150
P121b	>10,000	300	<.5	1,500	1	300	<5	70	150	<20	70	<2	50	--	15	7	30	150
P121c	7,000	300	<.5	1,500	1	300	<5	100	5	30	30	<2	20	--	10	30	30	300
P122	10,000	300	.5	2,000	2	500	7	150	70	50	<10	<2	30	--	15	30	50	300
P123	300	3,000	<.5	50	1	10	<5	15	5	<20	<10	<2	<10	--	<5	3	50	700
P124	7,000	150	<.5	300	2	100	10	30	50	20	15	<2	20	--	7	7	50	70
P126	1,500	100	<.5	500	1	50	<5	15	7	<20	<10	<2	<10	--	<5	7	20	50
P127	1,500	500	<.5	200	1	70	<5	15	100	20	10	<2	<10	--	<5	5	300	<50
P128	3,000	300	<.5	200	1	70	<5	30	30	<20	15	<2	10	--	7	7	30	100
P130	10,000	1,500	.7	1,500	2	300	50	300	100	<20	<10	<2	30	--	30	70	15	150
P131	200	150	<.5	2,000	1	10	<5	15	3	<20	10	<2	<10	--	<5	15	10	200
P132	3,000	1,000	<.5	>5,000	3	70	10	150	10	30	20	<2	10	--	10	70	20	150
P136	10,000	300	<.5	700	1	200	10	30	5	100	<10	<2	30	--	10	7	15	300
P137	10,000	300	<.5	1,500	2	200	10	70	7	20	<10	<2	30	--	15	7	30	300
P138	10,000	300	<.5	1,000	2	150	15	70	20	20	10	<2	70	--	15	10	20	300
P139	>10,000	1,000	<.5	700	1	300	5	30	5	70	10	<2	30		7	3	<10	300
P140a	>10,000	1,000	<.5	700	2	700	30	200	30	20	15	<2	70	--	30	70	15	500
P140b	>10,000	1,000	<.5	150	1	100	10	20	3	100	30	<2	30	--	20	7	10	150
P142	1,500	150	<.5	700	7	70	<5	15	70	30	70	7	30	--	5	7	70	70
P147a	>10,000	1,500	<.5	500	2	100	70	20	30	20	<10	<2	70	--	30	5	30	300
P147b	1,000	100	.5	1,500	1	50	<5	5	7	<20	<10	<2	20	--	<5	3	50	300
P148	10,000	700	<.5	1,000	1	300	5	150	70	50	<10	<2	30	--	20	5	30	100
P149a	7,000	500	<.5	3,000	1	150	5	100	20	30	<10	<2	30	--	15	15	30	1,000
P149b	2,000	300	<.5	3,000	1	150	<5	70	7	20	<10	<2	20	--	5	7	50	500
P149c	10,000	500	<.5	1,500	2	300	5	5	10	<20	15	<2	30	--	15	<2	20	1,500
P150a 1/	3,000	150	<.5	3,000	2	300	<5	<5	100	30	<10	2	20	--	<5	<2	30	500
P150b	>10,000	1,500	<.5	300	<1	20	70	20	15	<20	10	<2	20	--	30	7	15	700
P152	10,000	300	<.5	1,500	1	150	5	150	20	50	<10	<2	30	--	10	7	50	1,500
P161	5,000	100	3	1,000	1	100	<5	30	30	<20	10	70	20	--	5	2	70	150
P162a	7,000	70	<.5	500	2	150	<5	100	30	30	150	2	30	--	20	7	70	100
P162b	>10,000	1,500	<.5	10,000	3	200	30	200	70	30	10	<2	30	--	30	70	30	200
P163a	30	150	<.5	10	1	<10	<5	<5	<2	<20	15	<2	<10	--	<5	2	<10	<50
P163b	300	700	<.5	150	1	15	<5	15	15	<20	<10	<2	<10	--	<5	7	10	<50
P163c	10,000	150	2	5,000	1	150	<5	150	50	30	<10	3	15	--	15	7	150	150
P164a	1,000	700	<.5	70	2	30	<5	20	5	<20	10	<2	<10	--	5	10	10	<50
P164b	10,000	70	<.5	1,500	1	300	<5	100	50	30	10	5	20	--	15	<2	300	100
P164c 2/	5,000	150	.5	700	2	150	<5	70	70	50	<10	2	20	--	10	5	700	100
P165	1,500	100	<.5	700	1	50	<5	10	7	<20	<10	<2	<10	--	<5	5	15	<50

1/ Sample P150a contains 150 ppm W. All other samples contain less than 50 ppm W.

primitive area, Monterey County, Calif.—Continued

soluble heavy metals test, cxHM]

	Semiquantitative spectrographic analyses--Continued (ppm)			(percent)			Chemical analyses (ppm)			
Sample	V	Y	Zn	Fe	Mg	Ca	Hg	Au	cxHM	Sample description
						Altered rocks--Continued				
P99	50	<10	<200	>10	0.07	0.1	--	<0.1	--	Altered rock.
P101a	200	15	<200	5	.7	.2	0.020	<.1	--	Altered fault breccia.
P101b	15	10	<200	3	.7	.1	.020	.3	--	Do.
P102b	10	5	<200	3	.2	.3	.010	.2	--	FeO-stained aplite, float.
P103b	30	15	<200	5	2	1.5	.050	<.1	--	Fault breccia.
P104	30	10	<200	7	.5	.3	.050	<.1	--	FeO-stained sandstone, float.
P106	30	7	<200	.7	.3	.3	<.010	<.1	--	Sandstone.
P110a	300	15	<200	7	2	7	.020	<.1	--	Altered rock, float.
P110b	100	5	<200	7	.5	.7	.020	<.1	--	Do.
P110c	100	7	<200	7	.7	.7	.020	.4	--	Do.
P117b	100	15	<200	10	2	5	.040	.4	--	FeO-stained mica schist, float.
P118b	150	20	<200	10	3	15	.030	<.1	--	Altered rock, float.
P121a	30	10	<200	7	.7	1	.125	.3	--	Do.
P121b	70	10	<200	20	2	1	.050	<.1	--	Do.
P121c	30	10	<200	5	2	1.5	.020	<.1	--	Do.
P122	100	20	<200	5	2	15	.050	<.1	--	Quartzite.
P123	10	5	<200	7	7	15	.040	<.1	--	FeO-stained carbonate rock.
P124	30	5	<200	5	.7	.2	.020	<.1	--	Sandstone.
P126	15	<5	<200	.7	.3	.1	.020	<.1	--	Quartz vein.
P127	20	5	<200	1.5	.7	1	<.010	<.1	--	Do.
P128	30	7	<200	3	1	1.5	.110	<.1	--	Silicified mudstone.
P130	150	15	<200	7	3	7	.030	<.1	--	Sheared gneiss.
P131	30	7	<200	.7	7	20	.010	<.1	--	Silicated marble.
P132	500	150	500	5	10	10	.060	.1	--	Mica-rich soil.
P136	50	15	<200	7	2	1.5	.020	<.1	--	Chloritic(?) fracture filling.
P137	70	10	<200	7	3	1	.100	<.1	--	Gouge.
P138	70	15	<200	7	3	1.5	.100	<.1	--	Do.
P139	50	10	<200	7	3	1	.040	<.1	--	Do.
P140a	100	20	<200	15	3	10	.190	<.1	--	Sheared rock from fault.
P140b	200	20	<200	10	3	7	.360	<.1	--	Do.
P142	300	10	200	15	.2	.7	2.000	.2	--	Limonite fracture filling.
P147a	300	30	<200	15	3	10	.030	<.1	--	Altered rock, float.
P147b	20	7	<200	3	.5	.3	.030	<.1	--	Do.
P148	50	30	<200	7	3	.7	.150	<.1	--	FeO-stained schist, float.
P149a	70	15	<200	3	1.5	2	.060	<.1	--	Altered rock, float.
P149b	50	5	<200	2	.7	1	.010	<.1	--	Do.
P149c	70	10	<200	10	3	3	.310	<.1	--	Do.
P150a	15	<5	<200	7	1	1.5	.130	<.1	--	Granitic rock
P150b	300	20	<200	15	5	15	.050	<.1	--	Amphibolite.
P152	70	5	<200	7	3	1.5	.010	<.1	--	FeO-stained gneiss.
P161	700	5	<200	7	.3	.15	.030	<.1	--	FeO-stained graphitic schist.
P162a	100	30	<200	7	1.5	.5	.120	.1	--	Brecciated shale.
P162b	150	15	<200	10	3	2	.080	<.1	--	Brecciated gneiss.
P163a	15	<5	<200	.5	10	.3	.010	<.1	--	FeO-stained marble.
P163b	10	7	<200	1.5	1.5	.3	.040	<.1	--	Silicated marble.
P163c	200	15	<200	3	.7	.3	.210	.3	--	Do.
P164a	20	10	<200	3	3	1.5	.080	<.1	--	Pyritic gneiss.
P164b	100	15	<200	3	.7	.15	.100	<.1	--	Do.
P164c	50	10	<200	5	.7	.1	.160	<.1	--	Do.
P165	30	<5	<200	.7	.3	.07	.120	<.1	--	Quartz vein.

2/ Sample P164c contains 300 ppm As. All other samples contain less than 200 ppm As.

TABLE 1.—*Analyses of samples from the Ventana*

[Parts per million, ppm; citrate

Sample	Ti	Mn	Ag	Ba	Be	Zr	Co	Cr	Cu	La	B	Mo	Ga	Nb	Sc	Ni	Pb	Sr
	Semiquantitative spectrographic analyses (ppm)																	
						Altered rocks--Continued												
P166	1,000	>5,000	<0.5	200	1	50	<5	15	30	<20	10	<2	<10	--	7	10	50	<50
P167	10,000	300	<.5	1,500	1	150	7	150	30	<20	<10	<2	<10	--	20	7	<10	50
P168	500	70	<.5	1,500	1	100	<5	15	7	<20	<10	<2	15	--	<5	20	70	300
P169	1,000	1,500	<.5	150	3	50	5	15	20	20	<10	<2	<10	--	5	7	15	<50
P170a	300	500	<.5	300	1	100	<5	7	50	<20	15	<2	15	--	<5	7	15	<50
P170b	7,000	3,000	<.5	700	1	300	7	5	50	20	10	<2	20	--	10	30	10	<50
P170c	700	200	<.5	1,500	1	30	<5	15	30	<20	<10	<2	<10	--	<5	5	10	<50
P171	1,000	50	<.5	1,500	1	50	<5	20	20	<20	<10	<2	10	--	<5	2	100	<50
P172	700	70	<.5	1,500	2	50	<5	7	7	50	<10	<2	20	--	<5	3	100	100
P173	500	1,000	<.5	70	2	<10	<5	20	7	<20	<10	<2	10	--	7	15	10	<50
P184	7,000	150	<.5	1,000	3	700	5	70	30	100	20	<2	30	--	15	20	50	300
P189	1,500	150	<.5	700	2	50	<5	20	50	<20	<10	30	20	--	<5	5	50	150
P191b	300	1,500	<.5	300	1.5	70	5	10	30	<20	10	<2	<10	--	<5	5	20	<50
P193	100	300	<.5	70	5	<10	<5	<5	30	<20	15	<2	15	--	5	3	20	300
P198a	1,000	1,000	<.5	1,000	2	70	<5	20	5	30	<10	<2	15	--	<5	10	20	300
P198b	10,000	1,000	<.5	150	3	300	15	100	300	50	10	<2	30	--	20	30	30	300
P198c	700	300	<.5	2,000	1	70	<5	30	30	<20	<10	<2	10	--	<5	5	50	300
P199	>10,000	150	<.5	300	<1	1,000	15	150	200	100	30	<2	50	--	30	30	10	150
P200	7,000	300	<.5	1,500	1.5	500	5	10	30	200	<10	<2	30	--	7	2	30	1,000
P206	300	300	<.5	200	2	30	5	7	100	<20	<10	<2	<10	--	5	5	<10	<50
P208	700	300	<.5	150	1	<10	<5	5	50	20	<10	<2	<10	--	5	3	10	<50
P216b	2,000	300	<.5	500	<1	70	7	150	3	50	<10	<2	15	--	10	20	30	700
P218	2,000	5,000	<.5	70	1	70	<5	30	100	<20	10	<2	<10	--	7	50	<10	<50
P220	1,500	70	<.5	1,000	<1	70	<5	50	200	30	15	<2	15	--	5	3	15	150
P224	3,000	1,000	<.5	70	<1	70	20	1,500	300	<20	20	<2	30	--	30	50	10	150
P225	7,000	1,500	<.5	200	2	100	15	300	50	70	15	<2	20	--	15	30	30	700
P250	5,000	3,000	<.5	100	3	70	20	100	50	30	20	<2	20	--	15	50	<10	300
P251	10,000	150	<.5	200	<1	70	10	700	50	50	<10	<2	30	--	15	30	30	300
P255	3,000	200	<.5	30	5	70	5	150	30	30	<10	<2	30	--	7	20	15	150
P262	300	3,000	<.5	300	1	300	5	5	30	100	<10	<2	30	--	30	<2	20	300
P263	7,000	300	.7	150	1	150	<5	700	50	30	<10	<2	15	--	15	30	30	100
H2b	5,000	1,000	<1	1,000	<1	--	20	300	70	<30	--	10	--	<10	--	70	10	500
H8	1,000	150	<1	150	<1	--	<3	20	20	<30	--	<3	--	<10	--	3	<10	30
H9	1,500	150	<1	500	1.5	--	<3	50	100	<30	--	7	--	<10	--	15	<10	100
H13	3,000	700	<1	1,000	<1	--	10	150	100	<30	--	<5	--	<10	--	30	<10	200
H14b	5,000	1,500	<.5	100	<1	30	150	>5,000	300	<20	15	<2	20	--	50	100	<10	300
H14c	1,500	300	<.5	30	1	10	70	>5,000	150	<20	15	<2	20	--	30	1,500	<10	50
H21	1,000	3,000	<1	500	<1	--	<3	70	150	<30	--	<5	--	<10	--	10	<10	70
H22	5,000	3,000	<1	200	3	--	150	200	300	30	--	7	--	15	--	150	<10	20
H29	2,000	200	<1	500	<1	--	3	70	20	50	--	<3	--	--	--	20	<10	100
H33	500	30	<1	300	<1	--	<3	2	10	<30	--	<5	--	--	--	<3	10	20
H34	100	20	<1	300	<1	--	<3	1.5	15	<30	--	<3	--	--	--	<3	15	50
H35	1,500	>5,000	<.5	70	1	150	7	200	300	20	50	10	15	--	20	20	<10	<50
H41	5,000	500	<.5	700	2	70	7	50	50	70	15	<2	20	--	15	30	20	70
H44	>10,000	300	<.5	3,000	<1	150	<5	150	70	150	10	<2	30	--	20	5	50	2,000
H45	7,000	70	<.5	1,500	<1	150	<5	300	70	30	30	<2	70	--	20	3	30	1,500
H47	7,000	1,500	<.5	100	2	200	50	150	30	50	15	<2	20	--	30	70	<10	700
H48a	>10,000	300	<.5	500	2	100	15	200	30	<20	15	<2	30	--	30	30	200	1,500
H50	>10,000	1,500	<.5	500	2	300	100	150	200	70	10	<2	30	--	30	70	<10	100
H64	2,000	200	<.5	20	<1	150	<5	20	20	30	10	<2	<10	--	<5	2	<10	<50
H65	700	300	<.5	2,000	1	100	<5	30	20	<20	<10	<2	10	--	<5	7	20	200
H67	3,000	500	<.5	2,000	1	150	<5	10	7	20	<10	<2	20	--	5	5	70	500
H70 3/	150	3,000	<.5	30	1	10	7	<5	200	20	10	<2	<10	--	<5	<2	20	200
H73	3,000	1,500	<.5	700	3	150	20	150	70	<20	15	<2	30	--	20	30	30	200
H74	150	300	<.5	<10	<1	<10	150	>5,000	3	<20	15	<2	<10	--	7	5,000	<10	<50

3/ Sample H70 contains 70 ppm Sn. All other samples contain less than 10 ppm Sn.

primitive area, Monterey County, Calif.—Continued

soluble heavy metals test, cxHM]

Sample	Semiquantitative spectrographic analyses--Continued (ppm)			(percent)			Chemical analyses (ppm)			Sample description
	V	Y	Zn	Fe	Mg	Ca	Hg	Au	cxHM	
						Altered rocks--Continued				
P166	30	15	<200	5	0.15	0.7	0.400	<0.1	--	Quartz-siderite(?) gneiss.
P167	100	10	<200	5	.7	.7	.500	<.1	--	Granitic rock.
P168	10	<5	<200	1	.15	.7	.220	.4	--	Pegmatite.
P169	50	5	<200	3	.7	2	.200	.1	--	Quartz veinlet.
P170a	15	5	<200	.7	.1	.07	.020	<.1	--	Silicified gneiss.
P170b	30	5	<200	5	1	.15	.030	<.1	--	Silicified gneiss.
P170c	20	5	<200	1	.2	.2	.020	.2	--	Do.
P171	70	5	<200	7	.2	.07	.220	<.1	--	Do.
P172	15	5	<200	1.5	.5	.3	.130	<.1	--	Sheared argillized pegmatite.
P173	70	7	<200	3	.7	.5	.200	<.1	--	Limonite-quartz rock.
P184	100	50	<200	10	1.5	1	.050	.1	--	FeO-stained sandstone.
P189	30	<5	<200	3	.7	1	.130	<.1	--	Pyritic quartzite, float.
P191b	10	5	<200	7	.2	.15	<.010	<.1	--	Limonitic fracture filling.
P193	10	7	<200	1	.2	1.5	<.010	<.1	--	Argillized aplite.
P198a	10	10	<200	3	1.5	7	<.010	<.1	--	Fault breccia.
P198b	100	30	<200	7	3	1.5	.200	<.1	--	Do.
P198c	15	5	<200	1	.7	2	.200	<.1	--	Do.
P199	100	15	<200	15	3	1.5	.300	<.1	--	Limonitic fracture coatings
P200	15	10	<200	5	1	2	.070	<.1	--	Sheared pegmatite.
P206	15	7	<200	5	.3	.5	<.010	<.1	--	Calcareous quartzite.
P208	15	<5	<200	3	1	3	.210	<.1	--	FeO-stained pegmatite, float.
P216b	30	10	<200	5	3	>20	.050	<.1	--	Amphibolite.
P218	150	20	<200	15	1.5	.7	.150	<.1	--	Fault breccia.
P220	300	<5	<200	10	.5	.3	.050	<.1	--	Migmatitic mica schist.
P224	100	7	<200	15	10	10	<.010	<.1	--	Limonitic calc-silicate rock.
P225	20	15	<200	3	3	20	<.010	<.1	--	Do.
P250	50	15	<200	10	3	10	.200	<.1	--	Fracture fillings in parageiss, float.
P251	100	15	<200	7	.7	15	<.010	<.1	--	Calc-silicate rock.
P255	50	10	<200	3	.7	20	<.010	<.1	--	Do.
P262	10	>200	<200	7	.7	5	.030	<.1	--	Argillized granite.
P263	300	30	<200	3	3	7	.060	.2	--	Gray gouge.
H2b	300	20	<200	7	1	2	.015	<.1	--	FeO-stained schist, float.
H8	20	<10	<200	1.5	.5	.1	--	<.1	--	Limonite fault gouge.
H9	200	10	<200	5	.7	.7	--	<.1	--	Do.
H13	150	20	<200	7	1.5	1	--	<.1	--	FeO-stained schist, float.
H14b	150	10	<200	10	10	15	.020	<.1	--	Weathered peridotite.
H14c	70	5	200	15	7	3	1.480	<.1	--	Deeply weathered peridotite.
H21	300	20	<200	>10	.7	.5	--	<.1	--	Fracture filling in peridotite, float.
H22	200	700	200	>10	1.5	.1	--	<.1	--	Fracture filling in schist.
H29	50	20	<200	3	1	.05	--	<.1	--	Limonitic fault gouge.
H33	15	<10	<200	5	.02	.02	--	<.1	--	Do.
H34	<7	<10	<200	.1	.03	.03	--	<.1	--	Quartz vein.
H35	300	50	<200	15	3	2	.070	<.1	--	FeO-stained schist.
H41	30	20	<200	10	1	.2	.200	<.1	--	Limonitic fault gouge.
H44	100	20	<200	7	3	15	.020	<.1	--	Limonitic schist.
H45	30	10	<200	15	3	3	<.010	<.1	--	Do.
H47	100	30	<200	10	2	10	.020	<.1	--	Altered rock.
H48a	100	10	<200	10	7	>20	.030	<.1	--	Limonitic calc-silicate rock.
H50	100	20	<200	10	3	10	.030	.2	--	Limonitic schist.
H64	30	5	<200	2	.7	.7	.020	<.1	--	Quartz vein.
H65	10	5	<200	.7	.3	1.5	.040	<.1	--	Do.
H67	15	15	<200	3	.7	1.5	.020	<.1	--	Do.
H70	15	15	<200	15	1.5	>20	.070	<.1	--	Do.
H73	70	20	<200	7	3	.7	.020	.2	--	Fault breccia.
H74	15	<5	<200	15	10	.05	.290	<.1	--	Serpentine in fault.

TABLE 1.—*Analyses of samples from the Ventana*

[Parts per million, ppm; citrate

Sample	Semiquantitative spectrographic analyses (ppm)																	
	Ti	Mn	Ag	Ba	Be	Zr	Co	Cr	Cu	La	B	Mo	Ga	Nb	Sc	Ni	Pb	Sr
						Altered rocks--Continued												
H83	300	300	<0.5	1,000	1	700	<5	7	5	<20	<10	<2	10	--	7	<2	30	70
H86	>10,000	500	<.5	500	2	300	20	70	150	50	15	<2	50	--	30	30	15	500
H87	2,000	150	<.5	1,500	1	20	7	10	50	<20	<10	<2	30	--	5	7	100	1,000
H98	3,000	100	<.5	3,000	<1	70	<5	5	30	20	<10	<2	30	--	5	<2	30	1,500
H103	5,000	1,000	<.5	300	1	70	7	70	50	50	10	<2	30	--	30	20	20	1,000
H106	7,000	300	<.5	1,000	<1	300	5	100	30	100	<10	<2	30	--	10	10	30	1,000
H118	10,000	2,000	<.5	1,500	1	300	70	150	20	50	10	<2	50	--	30	30	50	500
H127	700	300	2	700	7	<10	<5	5	20	<20	<10	<2	30	--	<5	5	3,000	500
H134	200	70	<.5	70	2	<10	<5	150	1,000	<20	100	<2	30	--	7	30	<10	<50
H137	30	70	<.5	20	1	<10	<5	<5	150	<20	100	<2	30	--	<5	<2	<10	<50
H140	150	5,000	<.5	300	1	10	<5	5	7	<20	<10	<2	20	--	<5	3	70	100
H149	30	50	<.5	<10	1	<10	<5	<5	5	<20	<10	<2	<10	--	<5	3	10	<50
H152	5,000	150	<.5	700	3	150	<5	50	50	<20	150	<2	70	--	10	5	10	70
H163	10,000	700	<.5	1,500	2	200	50	500	100	70	10	<2	50	--	30	30	30	300
H175	700	>5,000	<.5	70	3	50	5	30	200	<20	30	<2	15	--	5	3	<10	<50
H176	10,000	500	<.5	30	<1	30	15	700	30	200	15	<2	30	--	30	50	15	100
						Spring deposits												
P116	150	15	<.5	30	<1	<10	<5	<5	<2	20	<10	<2	<10	--	<5	<2	<10	1,000
P177	500	300	<.5	150	<1	10	<5	150	3	20	70	<2	<10	--	5	15	10	300
P190	5,000	300	<.5	1,000	1	100	<5	50	10	20	<10	<2	10	--	7	7	20	300
P117	700	200	<.5	150	<1	30	<5	20	2	<20	<10	<2	<10	--	<5	3	<10	500
P267a	<10	100	<.5	70	5	<10	<5	<5	5	<20	50	<2	<10	--	<5	15	<10	<50
						Stream sediments												
P3	2,000	300	<1	700	1	--	7	70	7	30	--	<3	--	<10	--	20	10	500
P4	3,000	300	<1	700	1	--	10	100	7	50	--	<3	--	<10	--	20	10	500
P6	1,500	200	<1	1,000	1.5	--	3	30	7	30	--	<3	--	<10	--	10	15	200
P8	5,000	700	<1	1,000	1	--	15	100	50	30	--	<3	--	<10	--	50	10	200
P9	3,000	500	<1	1,000	1	--	10	100	30	50	--	<3	--	<10	--	50	15	200
P10	3,000	200	<1	1,500	1	--	5	70	7	30	--	<3	--	<10	--	15	10	300
P11	3,000	500	<1	1,000	1	--	7	30	10	30	--	<3	--	10	--	15	10	200
P12a	3,000	500	<1	1,000	1	--	10	50	10	30	--	<3	--	10	--	15	10	300
P13	2,000	300	<1	700	1	--	3	20	7	30	--	<3	--	<10	--	10	10	200
P20	2,000	300	<1	700	1	--	7	20	7	<30	--	<3	--	<10	--	10	10	200
P21a	3,000	700	<1	700	1.5	--	7	30	7	30	--	<3	--	10	--	15	10	200
P31	3,000	3,000	<1	500	<1	--	15	70	20	70	--	<3	--	<10	--	20	<10	200
P36	7,000	700	<1	500	<1	--	20	100	70	30	--	<3	--	10	--	70	<10	200
P40	3,000	700	<1	700	<1	--	15	70	30	70	--	<3	--	10	--	30	10	200
P41	10,000	700	<.5	700	3	300	50	150	30	70	<10	<2	30	--	30	20	15	700
P44	3,000	300	<1	700	<1	--	7	50	10	30	--	<3	--	--	--	5	10	300
P55	3,000	700	<1	500	<1	--	10	50	20	<30	--	<3	--	<10	--	10	<10	150
P56	10,000	1,500	<.5	500	3	300	20	200	30	70	10	<2	30	--	30	30	15	300
P57	7,000	1,000	<.5	700	1	300	10	70	7	70	<10	<2	30	--	20	10	15	200
P58	5,000	500	<1	500	<1	--	15	150	20	<30	--	<3	--	10	--	70	<10	150
P59	5,000	500	<.5	300	3	300	<5	<5	3	50	<10	<2	20	--	20	<2	20	70
P62	3,000	300	<1	500	<1	--	7	30	20	<30	--	<3	--	<10	--	15	10	150
P63	1,500	200	<1	700	<1	--	5	30	15	<30	--	<3	--	<10	--	10	10	100
P64	1,500	150	<1	700	<1	--	3	50	15	<30	--	<3	--	<10	--	10	10	100
P78a	5,000	500	<1	700	1	--	10	30	15	30	--	<3	--	<10	--	7	<10	200
P85e	3,000	700	<1	500	1	--	15	70	30	50	--	<3	--	10	--	20	<10	200
P86	3,000	300	<1	700	<1	--	10	70	50	<30	--	<3	--	<10	--	15	<10	150
P93	2,000	300	<1	700	1	--	10	50	7	50	--	<3	--	<10	--	15	10	150
P102a	10,000	300	<.5	700	2	300	7	100	7	100	<10	<2	20	--	15	20	15	200
P103a	10,000	300	<.5	500	2	300	10	100	30	50	<10	<2	20	--	10	15	20	150

primitive area, Monterey County, Calif.—Continued

soluble heavy metals test, cxHM]

	Semiquantitative spectrographic analyses--Continued (ppm)			(percent)			Chemical analyses (ppm)			
Sample	V	Y	Zn	Fe	Mg	Ca	Hg	Au	cxHM	Sample description
					Altered rocks--Continued					
H83	10	50	<200	2	0.15	1	0.060	<0.1	--	Fault gouge.
H86	100	20	<200	10	3	7	.090	<.1	--	Limonitic fault gouge.
H87	15	5	<200	3	.7	2	.050	<.1	--	Vein material.
H98	15	<5	<200	5	1	2	.010	<.1	--	Fracture filling in granite.
H103	300	20	<200	10	7	15	.050	<.1	--	Fracture filling in amphibolite.
H106	70	10	<200	7	3	7	.030	<.1	--	Altered rock, float.
H118	150	10	<200	7	5	3	.280	<.1	--	Fault breccia.
H127	15	10	1,500	1	.3	5	.020	<.1	--	Vein material.
H134	200	15	700	>20	.02	.07	.090	<.1	--	Limonitic amphibolite.
H137	700	10	500	>20	<.02	.1	.080	<.1	--	Do.
H140	10	50	<200	3	.2	.2	.010	<.1	--	Quartz vein.
H149	10	5	<200	.7	.05	.15	.050	<.1	--	Do.
H152	70	10	200	20	.7	.3	.040	<.1	--	Limonitic siltstone.
H163	100	30	<200	10	3	1	.080	<.1	--	FeO-stained amphibolite.
H175	100	15	<200	15	.15	.5	.150	<.1	--	Do.
H176	150	20	<200	10	5	3	.050	<.1	--	Limonitic gouge.
					Spring deposits					
P116	10	<5	<200	.05	.7	>20	.110	<.1	--	Travertine.
P177	30	5	<200	3	5	>20	.060	<.1	--	Do.
P190	30	10	<200	3	1	15	.080	<.1	--	Do.
H117	15	5	<200	1	1	20	<.010	<.1	--	Do.
P267a	10	10	500	10	.05	1.5	--	--	--	Iron hydroxides.
					Stream sediments					
P3	70	15	<200	2	1	1.5	.015	<.1	1	Stream sediment.
P4	100	15	<200	3	1.5	3	<.010	<.1	<.5	Do.
P6	50	10	<200	2	.7	1	.025	<.1	.5	Do.
P8	150	20	<200	5	2	3	<.010	<.1	2	Do.
P9	100	15	<200	3	1.5	3	.015	<.1	6	Do.
P10	70	15	<200	3	1	2	<.010	<.1	.5	Do.
P11	70	15	<200	3	1.5	.7	.015	<.1	1	Do.
P12a	100	20	<200	3	1.5	1	<.010	<.1	3	Do.
P13	50	15	<200	1	.7	1.5	<.010	<.1	1	Do.
P20	50	15	<200	2	.7	1.5	.015	<.1	<.5	Do.
P21a	70	15	<200	3	1	1	<.010	<.1	<.5	Do.
P31	100	100	<200	7	1.5	1	<.010	<.1	1	Do.
P36	20	30	<200	5	3	3	--	<.1	.5	Do.
P40	150	20	<200	5	1.5	1	<.010	<.1	2	Do.
P41	70	30	<200	7	3	3	.080	<.1	2	Do.
P44	70	15	<200	3	1.5	1.5	--	<.1	.5	Do.
P55	100	20	<200	5	1.5	1.5	--	<.1	1	Do.
P56	100	30	<200	7	3	3	.180	<.1	3	Do.
P57	30	50	<200	7	2	1.5	.060	<.1	1	Do.
P58	100	30	<200	5	2	1.5	--	<.1	2	Do.
P59	15	30	<200	7	.7	1	.030	<.1	3	Do.
P62	70	15	<200	3	1	1	--	<.1	1	Do.
P63	30	10	<200	2	.5	.7	--	<.1	2.5	Do.
P64	30	<10	<200	2	.5	.5	--	<.1	1	Do.
P78a	100	15	<200	5	1.5	1.5	--	<.1	1	Do.
P85e	150	20	<200	7	2	2	--	<.1	1	Do.
P86	150	20	<200	5	1.5	.7	--	<.1	1	Do.
P93	100	20	<200	5	1.5	.5	--	<.1	1	Do.
P102a	70	10	<200	5	2	1.5	.100	<.1	3	Do.
P103a	50	15	<200	7	2	1.5	.040	<.1	2	Do.

TABLE 1.—*Analyses of samples from the Ventana*

[Parts per million, ppm; citrate

	Semiquantitative spectrographic analyses (ppm)																	
Sample	Ti	Mn	Ag	Ba	Be	Zr	Co	Cr	Cu	La	B	Mo	Ga	Nb	Sc	Ni	Pb	Sr
								Stream sediments--Continued										
P108	10,000	700	<0.5	700	2	300	15	100	10	70	10	<2	15	--	15	20	15	200
P109	10,000	1,500	<.5	150	1	500	30	150	15	70	<10	<2	20	--	30	30	10	200
P110d	10,000	1,500	<.5	2,000	2	200	30	300	30	70	10	<2	30	--	20	70	30	500
P111	10,000	1,500	<.5	700	2	500	20	150	7	70	10	<2	20	--	30	7	10	300
P112	>10,000	1,500	<.5	700	1	500	70	200	10	50	<10	<2	30	--	30	20	10	700
P113	10,000	300	<.5	300	2	300	15	100	7	100	<10	<2	30	--	20	15	15	300
P114	10,000	1,500	<.5	700	<1	100	70	200	10	30	15	<2	20	--	30	30	10	700
P115	>10,000	1,500	<.5	700	<1	300	70	150	20	20	10	<2	30	--	30	20	15	500
P117a	10,000	1,500	<.5	700	2	300	30	150	20	100	15	<2	30	--	30	50	15	300
P118a	10,000	2,000	<.5	700	2	300	70	150	50	70	20	<2	20	--	30	70	15	300
P121d	>10,000	2,000	<.5	1,000	1	300	50	200	30	150	10	<2	20	--	30	30	15	500
P141	7,000	700	<.5	300	1	200	7	100	15	70	<10	<2	10	--	7	7	115	200
P143	7,000	1,000	<.5	150	2	200	20	150	30	70	<10	<2	20	--	15	70	15	150
P145	10,000	3,000	<.5	700	1	500	70	500	30	70	15	<2	30	--	30	100	10	300
P146	10,000	1,000	<.5	700	2	200	50	700	30	50	15	<2	30	--	30	30	30	500
P155	10,000	1,500	<.5	700	1	300	30	100	7	100	<10	<2	30	--	20	15	10	300
P156	10,000	500	<.5	1,000	2	300	20	150	10	30	<10	<2	15	--	15	15	10	300
P157	>10,000	1,500	<.5	700	1	700	70	200	20	50	<10	<2	30	--	30	30	10	700
P158	10,000	300	<.5	1,500	1	100	5	70	7	70	<10	<2	15	--	10	2	15	1,500
P159	7,000	200	<.5	1,500	2	500	<5	7	7	50	<10	<2	10	--	7	<2	30	1,000
P160	5,000	300	<.5	500	1	70	<5	15	30	30	<10	<2	20	--	5	3	50	700
P175	10,000	300	<.5	1,500	1	200	5	100	30	100	20	<2	15	--	15	15	20	300
P176	10,000	1,000	<.5	700	2	150	10	70	30	50	100	<2	30	--	15	30	20	100
P178	7,000	700	<.5	500	2	100	7	70	20	50	20	<2	30	--	20	30	30	150
P179	7,000	500	<.5	700	2	300	30	150	70	70	70	<2	30	--	20	70	30	300
P180	10,000	300	<.5	1,000	1	150	7	500	30	50	20	<2	30	--	20	30	20	500
P181	7,000	300	<.5	700	1	300	7	150	20	50	30	<2	30	--	15	30	20	300
P182	7,000	300	<.5	700	3	200	15	100	70	30	70	<2	30	--	15	30	30	150
P183	7,000	300	<.5	300	3	150	5	50	30	30	30	<2	20	--	10	30	20	100
P187	10,000	1,500	<.5	500	<1	500	70	300	30	150	10	<2	20	--	30	70	10	500
P195	10,000	2,000	<.5	150	3	200	50	500	70	50	15	<2	30	--	20	70	10	150
P197	10,000	1,500	<.5	700	3	150	50	300	50	70	10	<2	20	--	20	70	30	500
P201	10,000	1,000	<.5	200	2	700	50	150	30	100	10	<2	30	--	20	70	20	200
P202	>10,000	1,500	<.5	200	2	700	50	300	70	30	10	<2	30	--	30	70	15	200
P203	5,000	1,000	<.5	500	3	100	30	70	30	30	<10	<2	20	--	10	30	15	300
P204	7,000	1,500	1.5	300	<1	70	50	700	30	30	10	<2	15	--	30	300	10	200
P205	10,000	1,500	<.5	700	1	70	50	300	70	70	<10	<2	20	--	20	50	50	700
P207	10,000	1,500	<.5	300	2	300	30	150	30	100	10	<2	15	--	30	70	15	100
P209	10,000	1,500	<.5	300	2	500	50	500	70	70	10	<2	20	--	30	100	15	150
P210	10,000	1,000	<.5	1,000	1	200	20	500	50	30	<10	<2	15	--	15	70	15	300
P211	7,000	1,500	<.5	500	2	500	30	150	30	150	15	<2	30	--	30	50	15	500
P212	5,000	1,500	<.5	500	2	300	15	100	30	70	10	<2	<10	--	15	30	10	100
P213	7,000	300	<.5	1,500	2	100	50	200	30	50	<10	<2	30	--	15	70	30	300
P214	7,000	700	<.5	700	1	200	50	200	50	30	10	<2	30	--	15	100	20	300
P215	10,000	2,000	<.5	500	2	500	50	150	50	70	15	<2	30	--	30	70	20	300
P216a	5,000	2,000	<.5	1,000	<1	150	15	150	30	70	10	<2	30	--	30	30	20	500
P226	10,000	2,000	<.5	700	2	700	30	300	50	100	20	<2	30	--	30	70	30	300
P228	>10,000	3,000	<.5	700	1	700	50	300	30	200	30	<2	30	--	50	70	20	300
P229	10,000	1,000	<.5	700	2	300	50	500	20	70	15	<2	30	--	20	70	15	300
P230	10,000	1,000	<.5	700	2	300	50	200	15	150	15	<2	30	--	30	70	20	300
P231	7,000	3,000	<.5	700	2	500	70	500	30	100	10	<2	30	--	50	70	10	300
P233	10,000	2,000	<.5	300	1	300	50	150	70	100	10	<2	20	--	30	30	20	200
P237	7,000	700	<.5	500	3	500	20	150	50	50	10	<2	20	--	15	50	20	150
P238	7,000	1,000	<.5	1,000	2	300	30	150	70	50	10	<2	30	--	20	30	20	500
P239	5,000	500	<.5	500	1	100	20	150	30	50	<10	<2	30	--	20	30	30	30

primitive area, Monterey County, Calif.—Continued

soluble heavy metals test, cxHM]

	Semiquantitative spectrographic analyses--Continued (ppm)			(percent)			Chemical analyses (ppm)			
Sample	V	Y	Zn	Fe	Mg	Ca	Hg	Au	cxHM	Sample description
						Stream sediments--Continued				
P108	50	30	<200	5	1.5	1.5	0.240	<0.1	9	Stream sediment.
P109	150	20	<200	10	3	5	.180	<.1	2	Do.
P110d	100	20	<200	7	3	2	.050	.1	32	Do.
P111	70	20	<200	7	3	5	.280	.1	2	Do.
P112	150	20	<200	7	3	5	.040	<.1	2	Do.
P113	70	20	<200	5	2	2	.070	<.1	2.5	Do.
P114	100	15	<200	7	5	7	.220	<.1	2	Do.
P115	150	20	<200	15	5	7	.080	<.1	1	Do.
P117a	100	20	<200	7	3	3	.040	<.1	4	Do.
P118a	100	30	<200	10	3	7	.130	<.1	11	Do.
P121d	100	30	<200	10	3	7	.200	<.1	1	Do.
P141	50	15	<200	3	1.5	1.5	.210	<.1	3	Do.
P143	70	20	<200	7	3	2	.120	<.1	2	Do.
P145	150	70	<200	10	5	7	.050	.2	1	Do.
P146	100	20	<200	7	5	3	.070	<.1	1	Do.
P155	70	30	<200	7	3	3	.140	<.1	3	Do.
P156	70	20	<200	7	3	2	.040	.2	2	Do.
P157	150	30	<200	10	5	7	.040	<.1	2	Do.
P158	50	15	<200	5	3	7	.210	<.1	.5	Do.
P159	30	20	<200	3	1.5	7	.110	<.1	2	Do.
P160	30	7	<200	3	1	2	<.010	<.1	.5	Do.
P175	50	20	<200	5	3	1.5	.080	<.1	.5	Do.
P176	70	20	<200	7	2	1	.020	<.1	3	Do.
P178	70	30	<200	5	2	.7	<.010	<.1	1	Do.
P179	100	20	<200	7	3	1.5	.070	<.1	2	Do.
P180	70	10	<200	.5	3	1.5	.220	<.1	3	Do.
P181	70	20	<200	7	3	1.5	.050	<.1	2	Do.
P182	70	20	<200	5	2	.7	.090	<.1	1	Do.
P183	70	15	<200	5	1.5	.7	.120	<.1	2	Do.
P187	150	20	<200	7	3	3	.030	<.1	1	Do.
P195	150	30	<200	10	5	3	.070	.2	2	Do.
P197	70	15	<200	7	3	3	<.010	<.1	1	Do.
P201	70	20	<200	7	3	2	.130	.2	2	Do.
P202	150	30	<200	10	3	3	.140	<.1	2	Do.
P203	50	20	<200	5	2	1.5	.130	.2	3	Do.
P204	100	20	<200	7	7	10	.060	<.1	3	Do.
P205	100	30	<200	7	3	7	.050	<.1	1	Do.
P207	100	30	<200	7	3	2	.090	<.1	4	Do.
P209	150	70	<200	7	3	2	.120	.1	3	Do.
P210	100	20	<200	7	5	7	.080	<.1	3	Do.
P211	100	30	<200	10	3	3	.040	<.1	4	Do.
P212	70	30	<200	7	2	1.5	.100	<.1	7	Do.
P213	70	20	<200	7	3	2	.060	.1	3	Do.
P214	100	20	<200	7	3	2	.140	<.1	.5	Do.
P215	50	20	<200	7	3	1.5	.140	.1	2	Do.
P216a	50	20	<200	7	5	7	.030	<.1	1	Do.
P226	150	30	<200	15	3	2	.050	<.1	2	Do.
P228	100	100	<200	15	5	3	.040	<.1	2	Do.
P229	70	20	<200	7	3	1.5	.090	<.1	1	Do.
P230	70	30	<200	7	3	1.5	<.010	<.1	2	Do.
P231	70	100	<200	7	3	1.5	<.010	<.1	2	Do.
P233	100	50	<200	10	3	5	.060	<.1	2	Do.
P237	70	30	<200	7	2	1.5	.040	<.1	1	Do.
P238	70	20	<200	7	3	5	.030	<.1	2	Do.
P239	70	15	<200	7	3	7	.090	<.1	.5	Do.

TABLE 1.—*Analyses of samples from the Ventana*

[Parts per million, ppm; citrate

Sample	Semiquantitative spectrographic analyses (ppm)																	
	Ti	Mn	Ag	Ba	Be	Zr	Co	Cr	Cu	La	B	Mo	Ga	Nb	Sc	Ni	Pb	Sr
								Stream sediments--Continued										
P240	10,000	1,500	<0.5	500	2	300	50	200	30	100	10	<2	30	--	30	50	15	300
P243	7,000	1,500	<.5	500	2	150	50	150	70	100	30	<2	30	--	15	30	20	150
P246a	10,000	1,000	<.5	300	1.5	500	15	100	30	50	<10	<2	30	--	20	15	15	150
P246b	10,000	1,500	<.5	500	2	300	20	200	7	30	<10	<2	20	--	20	30	10	300
P247	5,000	1,000	<.5	500	5	300	15	100	15	200	<10	<2	30	--	10	30	20	100
P248a	10,000	1,500	<.5	1,000	2	300	50	300	30	100	20	<2	30	--	30	50	30	300
P248b	10,000	1,500	<.5	500	1	150	50	300	30	70	10	<2	30	--	30	30	15	300
P249a	10,000	500	<.5	500	3	300	30	150	7	100	10	<2	20	--	30	30	10	500
P249b	10,000	700	<.5	500	3	300	10	70	7	50	<10	<2	10	--	15	20	10	200
P257a	>10,000	3,000	<.5	1,000	2	700	30	300	30	70	20	<2	50	--	30	30	30	500
P257b	10,000	700	<.5	700	2	500	15	100	30	70	10	<2	30	--	20	30	10	300
P258	2,000	300	<.5	1,500	3	700	<5	7	15	100	<10	<2	30	--	10	<2	30	150
P259a 4/	>10,000	1,000	<.5	300	3	500	30	100	500	20	<10	<2	30	--	15	20	10	300
P259b	>10,000	1,500	<.5	700	1	300	7	30	5	70	15	<2	10	--	20	7	10	300
P260	>10,000	1,500	<.5	700	1	300	15	70	20	30	30	<2	30	--	30	20	15	300
P261a	>10,000	700	<.5	700	<1	700	15	150	10	50	15	<2	30	--	30	50	<10	500
P261b	7,000	1,000	<.5	500	3	200	5	30	15	100	<10	<2	30	--	10	15	20	100
P267b	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P269	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P270	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P271	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P272	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P274	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P276	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P277b	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P278	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P279a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P280a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P280b	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P281a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P281b	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P282	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P283	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P284a	--	--	--	---	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P284b	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P285a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P285b	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P286	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P287	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P288	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P289a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P289b	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P291	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
P292	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
H1	2,000	500	<1	3,000	<1	--	7	50	20	<30	--	<3	--	<10	--	15	<10	[illegible]
H2a	3,000	500	<1	1,000	1	--	10	30	15	70	--	<3	--	10	--	15	<10	500
H3	3,000	1,000	<1	700	1	--	15	70	15	50	--	<3	--	<10	--	30	10	200
H10	2,000	200	<1	1,000	<1	--	7	20	10	30	--	<3	--	<10	--	3	<10	500
H11	1,500	150	<1	1,000	<1	--	3	30	10	<30	--	<3	--	<10	--	10	10	200
H12	2,000	300	<1	1,000	<1	--	7	30	15	150	--	<3	--	<10	--	10	10	200
H15	2,000	300	<1	1,000	<1	--	7	50	20	30	--	<3	--	<10	--	15	[illegible]	150
H16	1,500	200	<1	1,000	<1	--	7	100	20	<30	--	<3	--	<10	--	20	10	150
H17	2,000	500	<1	700	1.5	--	7	30	30	30	--	<3	--	<10	--	15	10	150
H19	1,500	200	<1	1,000	<1	--	5	20	15	<30	--	<3	--	<10	--	10	10	150
H20	1,500	500	<1	700	<1	--	5	50	15	30	--	<3	--	<10	--	15	10	150
H25	1,500	300	<1	700	<1	--	10	70	20	<30	--	<3	--	<10	--	20	10	200
H36	3,000	300	<.5	1,500	2	70	5	50	20	20	<10	<2	20	--	7	[illegible]	50	1,000

4/ Chemical analyses of sample P259a give Cu 15 ppm, Pb <25 ppm, and Zn 38 ppm.

primitive area, Monterey County, Calif.—Continued

soluble heavy metals test, cxHM]

	Semiquantitative spectrographic analyses--Continued (ppm)			(percent)			Chemical analyses (ppm)			
Sample	V	Y	Zn	Fe	Mg	Ca	Hg	Au	cxHM	Sample description
							Stream sediments--Continued			
P240	100	30	<200	10	3	3	0.050	<0.1	2	Stream sediment.
P243	100	30	<200	10	3	1.5	.030	<.1	1	Do.
P246a	70	30	<200	7	3	3	.160	<.1	2	Do.
P246b	100	20	<200	7	3	3	.040	<.1	2	Do.
P247	50	70	<200	7	2	1.5	.260	<.1	3	Do.
P248a	150	50	<200	7	5	5	.120	<.1	2.5	Do.
P248b	100	30	<200	7	3	5	.040	<.1	2	Do.
P249a	100	30	<200	10	3	3	.170	<.1	1	Do.
P249b	70	20	<200	5	2	2	.140	<.1	4	Do.
P257a	150	30	<200	10	7	15	.040	<.1	1	Do.
P257b	70	30	<200	10	3	2	.090	<.1	3	Do.
P258	15	150	<200	7	.7	1	.050	<.1	3	Do.
P259a	70	20	<200	7	3	3	.040	<.1	--	Do.
P259b	70	20	<200	5	3	10	.020	<.1	2	Do.
P260	150	20	<200	10	3	7	.120	<.1	2	Do.
P261a	150	30	<200	10	3	7	.080	<.1	2	Do.
P261b	30	30	<200	7	1.5	1.5	.180	<.1	3	Do.
P267b	--	--	--	--	--	--	--	--	<.5	Do.
P269	--	--	--	--	--	--	--	--	<.5	Do.
P270	--	--	--	--	--	--	--	--	<.5	Do.
P271	--	--	--	--	--	--	--	--	<.5	Do.
P272	--	--	--	--	--	--	--	--	<.5	Do.
P274	--	--	--	--	--	--	--	--	<.5	Do.
P276	--	--	--	--	--	--	--	--	2	
P277b	--	--	--	--	--	--	--	--	<.5	Do.
P278	--	--	--	--	--	--	--	--	<.5	Do.
P279a	--	--	--	--	--	--	--	--	<.5	Do.
P280a	--	--	--	--	--	--	--	--	<.5	Do.
P280b	--	--	--	--	--	--	--	--	<.5	Do.
P281a	--	--	--	--	--	--	--	--	<.5	Do.
P281b	--	--	--	--	--	--	--	--	<.5	Do.
P282	--	--	--	--	--	--	--	--	<.5	Do.
P283	--	--	--	--	--	--	--	--	<.5	Do.
P284a	--	--	--	--	--	--	--	--	<.5	Do.
P284b	--	--	--	--	--	--	--	--	<.5	Do.
P285a	--	--	--	--	--	--	--	--	3	Do.
P285b	--	--	--	--	--	--	--	--	2	Do.
P286	--	--	--	--	--	--	--	--	3	Do.
P287	--	--	--	--	--	--	--	--	4	Do.
P288	--	--	--	--	--	--	--	--	1	Do.
P289a	--	--	--	--	--	--	--	--	<.5	Do.
P289b	--	--	--	--	--	--	--	--	1	Do.
P291	--	--	--	--	--	--	--	--	2	Do.
P292	--	--	--	--	--	--	--	--	3	Do.
H1	100	15	<200	3	1.5	7	<.010	<.1	3	Do.
H2a	100	20	<200	3	1.5	3	.015	<.1	2.5	Do.
H3	70	50	<200	5	1.5	1	.015	<.1	5	Do.
H10	70	10	<200	2	1	1.5	--	<.1	1	Do.
H11	30	10	<200	2	.7	.5	--	<.1	2	Do.
H12	70	15	<200	3	1	.7	--	<.1	.5	Do.
H15	100	20	<200	5	1	.7	--	<.1	2	Do.
H16	50	10	<200	3	1.5	.5	--	<.1	5	Do.
H17	70	15	<200	5	1	.5	--	<.1	2	Do.
H19	50	10	<200	3	.7	.3	--	<.1	1	Do.
H20	70	15	<200	2	1	1.5	--	<.1	1	Do.
H25	70	20	<200	3	1.5	1	--	<.1	2	Do.
H36	30	10	<200	3	1.5	2	.170	<.1	1	Do.

TABLE 1.—*Analyses of samples from the Ventana*

[Parts per million, ppm ; citrate

Sample	Semiquantitative spectrographic analyses (ppm)																	
	Ti	Mn	Ag	Ba	Be	Zr	Co	Cr	Cu	La	B	Mo	Ga	Nb	Sc	Ni	Pb	Sr
								Stream sediments--Continued										
H37	2,000	200	<1	700	<1	--	5	15	7	70	--	<3	--	--	--	3	<10	200
H38a	2,000	200	<1	700	<1	--	7	15	7	<30	--	<3	--	--	--	3	<10	300
H51	>10,000	1,000	<.5	700	2	300	50	200	70	70	15	<2	50	--	30	50	20	300
H52	10,000	1,000	<.5	1,000	2	100	30	100	30	20	<10	<2	30	--	20	30	15	700
H53	10,000	1,000	<.5	1,500	2	300	50	200	30	100	15	<2	30	--	30	70	30	500
H55	>10,000	2,000	<.5	1,000	2	300	70	150	50	70	15	<2	30	--	20	50	10	500
H56 5/	7,000	1,500	<.5	700	2	300	30	150	30	70	15	<2	30	--	20	50	200	300
H57	10,000	1,500	<.5	1,000	<1	300	70	100	50	70	<10	<2	20	--	15	50	20	300
H59	10,000	2,000	<.5	1,500	2	150	10	150	20	50	20	<2	15	--	15	30	15	300
H60	10,000	1,000	<.5	1,000	<1	300	10	150	50	50	<10	<2	30	--	30	30	30	500
H81	7,000	500	<.5	1,000	2	700	10	150	10	100	<10	<2	20	--	15	50	30	150
H82	10,000	1,000	<.5	700	3	300	15	100	70	70	10	<2	30	--	15	50	30	200
H85	10,000	1,000	<.5	300	1	300	30	150	30	70	<10	<2	30	--	20	30	20	300
H88	7,000	700	<.5	1,000	2	150	50	300	30	50	20	<2	20	--	20	300	30	500
H89	10,000	700	<.5	500	2	70	30	100	10	70	10	<2	30	--	30	30	15	300
H90	10,000	1,500	<.5	1,000	1	150	15	100	7	100	10	<2	30	--	15	7	20	700
H91	7,000	300	<.5	300	3	70	10	50	30	30	<10	<2	20	--	15	7	30	300
H92	>10,000	1,000	<.5	500	1	100	70	150	7	30	<10	<2	30	--	30	20	10	700
H93	10,000	1,000	<.5	500	2	70	70	300	15	30	10	<2	20	--	30	30	10	500
H94	10,000	1,000	<.5	300	1	150	50	200	20	20	10	<2	30	--	30	30	10	300
H96	10,000	1,000	<.5	1,000	2	300	30	150	30	70	20	<2	30	--	30	30	20	700
H97	10,000	1,500	<.5	700	1	100	50	200	10	70	10	<2	30	--	30	30	10	300
H99	10,000	1,000	<.5	500	2	200	50	150	7	100	<10	<2	20	--	30	30	15	300
H100	10,000	1,000	<.5	700	2	200	50	200	10	150	<10	<2	30	--	30	30	20	700
H101	7,000	1,000	<.5	700	1	150	30	100	30	50	<10	<2	30	--	20	50	15	150
H102	7,000	1,000	<.5	1,000	1	70	15	200	10	70	<10	<2	20	--	20	20	15	1,000
H104	10,000	700	<.5	700	1	200	50	200	30	100	10	<2	30	--	30	70	10	300
H105	7,000	1,500	<.5	1,000	3	300	30	150	70	50	<10	<2	30	--	20	30	20	300
H107	10,000	1,500	<.5	700	2	500	50	150	20	200	<10	<2	30	--	30	70	15	200
H108	10,000	1,000	<.5	1,500	1	300	20	150	30	100	15	<2	20	--	20	30	15	300
H109	10,000	500	<.5	700	1	200	10	150	5	70	15	<2	15	--	20	30	15	300
H110	>10,000	1,000	<.5	700	3	>1,000	70	500	15	150	<10	<2	20	--	30	50	<10	1,000
H111	10,000	500	<.5	1,000	1	700	50	300	30	50	<10	<2	20	--	30	100	10	700
H112	10,000	1,000	<.5	500	2	700	15	150	7	100	<10	<2	15	--	20	7	10	300
H113	10,000	1,500	<.5	700	2	500	20	150	30	200	<10	<2	30	--	20	10	15	500
H114	10,000	1,000	<.5	500	2	700	20	150	5	150	<10	<2	20	--	30	<2	10	300
H115	10,000	700	<.5	700	1	300	20	150	15	150	<10	<2	30	--	20	7	15	500
H119	3,000	300	1.5	700	1	300	<5	30	30	50	30	<2	20	--	7	20	20	70
H120	7,000	1,000	<.5	>5,000	3	300	20	150	50	100	70	<2	20	--	20	30	50	300
H121	7,000	300	<.5	300	2	200	5	50	50	30	20	<2	30	--	10	30	30	150
H122	10,000	500	<.5	1,000	2	200	30	100	30	30	20	<2	20	--	15	30	20	200
H123	5,000	700	<.5	500	2	200	5	70	10	50	20	<2	15	--	7	20	20	200
H124	7,000	700	<.5	700	2	70	20	100	30	50	15	<2	30	--	20	30	15	300
H125	7,000	700	<.5	1,000	3	300	10	150	50	200	20	<2	30	--	15	30	50	300
H128	7,000	300	<.5	700	2	150	20	100	30	30	30	<2	30	--	15	30	20	200
H129	5,000	200	<.5	700	3	150	5	70	30	30	70	<2	30	--	15	30	30	100
H130	5,000	300	<.5	1,000	3	200	15	150	30	70	70	<2	30	--	20	30	30	200
H131	7,000	700	<.5	700	1	150	20	150	50	20	<10	<2	20	--	15	30	30	700
H133	3,000	300	<.5	300	<1	100	5	100	7	100	<10	<2	<10	--	7	20	10	700
H141	7,000	1,000	<.5	150	1	70	30	150	30	50	<10	<2	15	--	15	70	15	300

5/ Chemical analyses of sample H56 give Cu 15 ppm, Pb 25 ppm, and Zn <25 ppm.

primitive area, Monterey County, Calif.—Continued

soluble heavy metals test, cxHM]

	Semiquantitative spectrographic analyses--Continued (ppm)			(percent)			Chemical analyses (ppm)			
Sample	V	Y	Zn	Fe	Mg	Ca	Hg	Au	cxHM	Sample description
							Stream sediments--Continued			
H37	50	15	<200	2	1	1.5	--	<0.1	1	Stream sediment.
H38a	50	10	<200	3	1	1.5	--	<.1	.5	Do.
H51	150	20	<200	15	5	5	0.040	.1	2	Do.
H52	70	15	<200	7	3	3	.200	<.1	3	Do.
H53	100	30	<200	7	3	2	.150	<.1	3	Do.
H55	100	30	<200	10	3	5	.020	<.1	2	Do.
H56	70	30	<200	7	3	3	.200	.3	3	Do.
H57	100	15	<200	10	3	3	.090	<.1	3	Do.
H59	100	15	<200	7	3	7	.220	<.1	5	Do.
H60	70	15	<200	7	3	5	.180	<.1	2	Do.
H81	50	15	<200	5	2	1.5	.280	<.1	2.5	Do.
H82	70	30	<200	7	3	1.5	.240	<.1	2	Do.
H85	150	30	<200	7	3	3	.080	<.2	2	Do.
H88	100	20	<200	.7	3	3	.120	.2	.5	Do.
H89	100	30	<200	7	3	3	.040	<.1	1	Do.
H90	100	20	<200	7	3	7	.140	<.1	1	Do.
H91	30	10	<200	7	1.5	2	.200	<.1	.5	Do.
H92	150	20	<200	7	5	3	.090	<.1	2	Do.
H93	100	20	<200	10	5	5	.030	<.1	2	Do.
H94	150	30	<200	10	5	7	.050	<.1	2	Do.
H96	150	30	<200	7	3	5	.050	<.1	3	Do.
H97	100	30	<200	7	5	5	.100	<.1	1	Do.
H99	100	30	<200	7	3	1.5	.140	<.1	3	Do.
H100	100	20	<200	7	5	5	.180	<.1	1	Do.
H101	100	20	<200	7	3	1.5	.030	<.1	3	Do.
H102	50	15	<200	5	3	3	<.010	<.1	2	Do.
H104	100	30	<200	10	5	3	.030	<.1	27	Do.
H105	100	30	<200	7	5	5	.180	<.1	2	Do.
H107	70	30	<200	7	3	2	.210	<.1	3	Do.
H108	70	30	<200	5	3	2	.090	<.1	1	Do.
H109	70	20	<200	7	3	10	.290	<.1	3	Do.
H110	100	50	<200	10	7	7	.140	<.1	2	Do.
H111	150	20	<200	7	3	3	.100	.1	3	Do.
H112	70	20	<200	7	3	3	.040	<.1	2	Do.
H113	150	30	<200	7	3	7	.030	<.1	3	Do
H114	100	30	<200	7	3	3	.050	.1	2	Do.
H115	150	70	<200	10	3	5	.120	.2	2	Do.
H119	30	15	<200	3	1	.5	.100	<.1	2	Do.
H120	100	30	<200	7	2	2	<.010	<.1	3	Do.
H121	50	10	<200	7	1.5	.7	.070	<.1	3	Do.
H122	70	20	<200	5	1.5	1	.140	<.1	1	Do.
H123	70	20	<200	3	1.5	3	.090	<.1	2.5	Do.
H124	70	20	<200	5	3	1.5	.080	<.1	1	Do.
H125	70	20	<200	5	2	2	.050	<.1	2.5	Do.
H128	70	15	<200	7	3	.7	<.010	<.1	1	Do.
H129	70	15	<200	5	1.5	.7	.030	<.1	3	Do.
H130	70	30	<200	5	2	1.5	.010	<.1	2.5	Do.
H131	50	15	<200	7	3	3	.170	<.1	3	Do.
H133	30	5	<200	2	2	20	.030	<.1	1	Do.
H141	100	20	<200	7	3	2	.170	<.1	2	Do.

TABLE 1.—*Analyses of samples from the Ventana*

[Parts per million, ppm; citrate

Sample	Semiquantitative spectrographic analyses (ppm)																	
	Ti	Mn	Ag	Ba	Be	Zr	Co	Cr	Cu	La	B	Mo	Ga	Nb	Sc	Ni	Pb	Sr
						Stream sediments--Continued												
H142	10,000	1,000	<0.5	1,000	1	300	30	150	30	20	<10	<2	30	--	20	50	20	700
H143	10,000	1,000	<.5	300	2	200	70	300	70	50	<10	<2	30	--	30	70	15	200
H144	7,000	500	<.5	1,000	3	200	20	100	30	20	50	<2	30	--	15	30	30	300
H145	>10,000	1,500	<.5	200	<1	300	50	500	30	30	<10	<2	15	--	30	70	<10	150
H146	>10,000	700	<.5	150	<1	500	30	30	20	100	20	<2	20	--	30	7	10	150
H153	>10,000	1,500	<.5	700	<1	300	30	70	70	70	30	<2	30	--	30	30	20	200
H154	7,000	300	<.5	1,000	1	300	5	150	20	70	30	<2	20	--	15	30	30	300
H155	10,000	1,500	<.5	200	1	200	20	70	30	50	20	<2	20	--	20	30	20	150
H156	10,000	2,000	<.5	500	1	200	50	150	50	150	10	<2	30	--	30	30	10	300
H157	10,000	1,000	<.5	200	1	300	20	70	30	30	10	<2	20	--	20	20	15	200
H158	7,000	700	<.5	150	1	200	50	200	30	30	<10	<2	20	--	20	70	20	300
H166	5,000	1,500	<.5	300	2	150	15	70	30	50	<10	<2	20	--	20	30	20	150
H169	7,000	1,500	<.5	500	3	200	70	700	50	70	15	<2	30	--	20	300	15	200
H170	10,000	1,500	<.5	300	1	100	30	300	30	150	10	<2	20	--	30	70	10	300
H171	10,000	1,500	<.5	300	1	200	70	300	30	70	10	<2	30	--	30	70	10	300
H172	7,000	1,500	<.5	700	1	200	50	700	20	70	10	<2	30	--	30	70	10	300
H177	10,000	300	<.5	700	2	300	5	30	5	<20	<10	<2	10	--	10	7	10	200
H178	7,000	500	<.5	700	1.5	200	5	30	7	100	<10	<2	15	--	15	7	10	150
H179	10,000	1,500	<.5	700	2	300	15	150	30	150	10	<2	15	--	15	15	15	300
H181	>10,000	1,500	<.5	700	2	500	20	300	30	50	30	<2	30	--	30	70	15	300
H182 6/	>10,000	1,000	<.5	700	2	1,000	20	300	20	50	10	<2	30	--	30	30	150	300
			Samples from Trampa Canyon copper prospect, northeast of primitive area															
P65	5,000	300	<.5	700	2	200	<5	7	10	<20	<10	<2	20	--	5	5	15	700
P66	7,000	500	<.5	500	2	200	5	10	7	150	<10	<2	30	--	7	3	15	700
P67 7/	10,000	500	<.5	1,500	1	70	7	20	200	150	<10	<2	30	--	14	7	20	1,500
P68	5,000	200	<.5	700	3	700	<5	5	70	<20	<10	<2	15	--	7	<2	20	1,500
P69	5,000	300	<.5	500	2	100	<5	5	10	20	20	<2	20	--	7	7	15	70
P70 8/	700	>5,000	<.5	<10	1	100	<5	20	1,500	<20	20	<2	15	--	<5	<2	<10	<50
P71	150	3,000	<.5	20	<1	<10	<5	5	300	<20	<10	<2	<10	--	<5	3	10	500
P72 8/	200	700	5	<10	<1	30	7	5	5,000	<20	50	<2	20	--	<5	<2	<10	<50
P73	150	1,500	<.5	<10	<1	10	<5	<5	1,500	<20	300	<2	30	--	<5	<2	<10	<50
P74	100	700	<.5	20	<1	<10	<5	<5	30	<20	<10	<2	<10	--	<5	<2	10	500
P75 8/	150	>5,000	5	30	2	15	150	5	>5,000	300	20	<2	30	--	<5	3	<10	<50
P76	2,000	300	<.5	70	1	500	<5	7	5	<20	<10	<2	<10	--	<5	<2	30	100
P77	7,000	300	<.5	300	3	500	15	30	30	30	<10	<2	20	--	15	10	20	300

6/ Chemical analyses of sample H182 give Cu 15 ppm, Pb <25 ppm, and Zn 25 ppm.

7/ Sample P67 contains 10 ppm Bi. All other samples contain less than 10 ppm Bi.

primitive area, Monterey County, Calif.—Continued

soluble heavy metals test, cxHM]

	Semiquantitative spectrographic analyses--Continued (ppm)			(percent)			Chemical analyses (ppm)			
Sample	V	Y	Zn	Fe	Mg	Ca	Hg	Au	cxHM	Sample description
					Stream sediments--Continued					
H142	200	50	<200	7	3	5	0.080	<0.1	1	Stream sediment.
H143	100	15	<200	7	5	3	.200	<.1	1	Do.
H144	100	20	<200	7	3	1.5	.070	.2	2	Do.
H145	100	30	<200	10	5	7	.160	<.1	3	Do.
H146	200	20	<200	10	3	1.5	.040	<.1	2	Do.
H153	100	50	<200	7	3	1.5	.220	.2	2.5	Do.
H154	70	15	<200	7	3	1.5	.080	<.1	1	Do.
H155	50	30	<200	10	2	1.5	.070	<.1	1	Do.
H156	70	50	<200	7	3	1.5	.050	<.1	1	Do.
H157	70	20	<200	7	2	1.5	.100	<.1	1	Do.
H158	70	15	<200	10	3	3	.040	<.1	2	Do.
H166	30	50	<200	10	1.5	1	.060	<.1	1	Do.
H169	100	50	<200	7	5	2	.200	<.1	3	Do.
H170	100	30	<200	7	3	5	.110	<.1	5	Do.
H171	100	30	<200	10	7	10	.030	<.1	2	Do.
H172	100	30	<200	10	5	3	.080	<.1	1	Do.
H177	70	10	<200	5	1.5	2	.230	<.1	4	Do.
H178	50	30	<200	5	1.5	1.5	.180	<.1	2	Do.
H179	100	30	<200	7	3	3	.110	<.1	3	Do.
H181	150	30	<200	10	7	7	.080	<.1	2	Do.
H182	150	20	<200	10	5	10	.030	<.1	--	Do.
					Samples from Trampa Canyon copper prospect, northeast of primitive area					
P65	30	7	<200	3	.7	1.5	.020	<.1	--	Granitic rock.
P66	30	15	<200	3	1	2	.020	<.1	--	Do.
P67	50	15	<200	7	2	2	<.010	<.1	--	Do.
P68	20	10	<200	3	.7	2	.040	<.1	--	Do.
P69	30	15	<200	3	1.5	.7	.030	.2	--	Do.
P70	20	5	500	20	3	20	.010	<.1	--	Garnet-rich skarn.
P71	10	<5	<200	2	3	>20	.020	<.1	--	Calcite, trace of malachite.
P72	<10	5	200	20	2	7	.460	<.1	--	Oxidized skarn.
P73	<10	5	300	>20	1.5	2	.050	<.1	--	Oxidized skarn.
P74	<10	<5	<200	.2	.7	>20	.040	.2	--	Calcite.
P75	20	20	300	15	.1	15	.040	.3	--	Limonitic skarn.
P76	30	5	<200	1.5	.7	3	.040	<.1	--	Brown carbonate rock.
P77	50	15	<200	7	3	2	.200	<.1	--	Stream sediment.

8/ Samples P70 and P72 contain 150 ppm Sn; P75 contains 200 ppm Sn. All other samples contain less than 10 ppm Sn.

EVALUATION OF METALLIC MINERALS

Visual examination of rocks and soils failed to reveal the presence of metallic mineral deposits. Faults, shear zones, and fractures were examined carefully but, except for a trace of lead and zinc at one locality, no mineralization was noted along them. Hydrothermal alteration, a common clue to mineralization, appears to be restricted to thin zones along fractures and faults; no evidence of accompanying metal deposition was seen. Many of the rocks, and especially the metamorphic rocks, are weathered to a friable aggregate of mineral grains stained by limonite as a result of the breakdown of iron-bearing silicate and oxide minerals. Many of the samples described as "altered rocks" in table 1 are weathered rocks of this type. Most of the faults are younger than the main igneous episode, and thus they were not present to act as passageways for any ore-forming fluids that may have been associated with the igneous rocks. The only veins observed are quartz veins up to about 1 foot thick that cut Upper Cretaceous sedimentary rocks; no ore minerals were found in these veins.

Locally, the metamorphic rocks, especially the quartz-rich varieties, contain scattered grains of iron sulfide accompanied by graphite, but no ore minerals were seen in these rocks. A rusty gossanlike weathered crust generally distinguishes the sulfidic gneisses. The sulfides are thought to be syngenetic, that is, they represent original sulfurous sedimentary beds, most of which were carbonaceous as well. Black shales typically have these characteristics and upon metamorphism could yield gneisses containing graphite and sulfide minerals.

The calc-silicate gneisses resemble tactites in mineralogy, but unlike tactites have no close spatial relation to igneous contacts, and they seem to be of regional metamorphic origin. The calc-silicate gneisses contain sporadically distributed sulfide minerals that probably are recrystallization products of the original sedimentary rocks, but small amounts of copper in some samples suggest the possibility of minor epigenitic mineralization, as in the following discussion.

The lack of visual indications of ore deposits is corroborated by the analytical data for 515 samples shown in table 1. The analytical results indicate that with a few exceptions, most of the samples contain only normal metal content and none of them contain metal in quantities approaching ore grade.

Analyses of fresh rocks show a wide range in the content of some metals, the quantity depending to a large degree on the rock types. Some of the intrusive and metamorphic rocks, and the hornblende-rich rocks in particular, contain as much as 200 ppm (parts per million) copper, and ultramafic intrusive rocks contain up to several tenths of a percent nickel and chromium. Such concentrations however, are not unusual for rocks of this type. It is unlikely that they are indicative of economically important concentrations. Comparable concentrations of copper, nickel, and chromium have been reported in amphibolite from Montana by Becraft and others (1966, p. B16, B17).

Gold and mercury analyses of all samples indicate no unusual or economically interesting concentrations of these elements.

Although the analyses of most samples listed in table 1 as "Altered rocks" obviously reflect the composition of the parent rock, a few may have been slightly enriched in metals, especially copper, lead, or zinc. Sample P16a is a sulfide-bearing calc-silicate rock from North Fork Little Sur River that was determined spectrographically to contain 1,500 ppm copper. Similar rock was resampled from the same locality, but the second sample contained only 10 ppm copper, which is indicative of the sporadic copper distribution. No copper minerals were visible at the site. Sample P88 contains 300 ppm copper and microscopically visible chalcopyrite. This sample was collected from a small boulder of amphibolite from Logwood Creek; its source is not known as only the one boulder could be found. Several other samples (P198b, H35, H134, H175) of sulfide-bearing amphibolite and other iron-rich metamorphic rocks were collected that give somewhat higher than average values for copper or zinc.

A sample of brecciated pegmatite from a fault in the "Coast Ridge fault zone" of Reiche (1937, p. 152) contained 1,500 ppm zinc and 3,000 ppm lead, the highest concentrations of lead and zinc found in the area. The zinc silicate calamine was identified in the sample but no lead mineral could be found. Neither the sample nor the other rocks in the vicinity show any obvious mineralization. The metals may be in the small amount of gouge along the fault, or they could have been in primary accessory minerals of the pegmatite. Sediment samples from streams that drain across this fault and other nearby faults are not unusually high in metals (see samples H123, H124, H125, H128, H129, P178 and P179).

The stream-sediment samples in general contain only small quantities of metals. Most of them contain 10 to 70 ppm copper and lead and less than 200 ppm zinc, the lower limit of detection by spectrographic analysis. Three samples, however, gave anomalously high spectrographic values: P259a, 500 ppm copper; H56, 200 ppm lead; and H182, 150 ppm lead. By colorimetric analysis, the three samples gave much lower results, in parts per million: P259a—copper 15, lead <25, zinc 38; H56—copper 15, lead 25, zinc <25; H182—copper 15, lead <25, zinc 25.

The citrate soluble heavy metals test (cxHM in table 1) was performed on stream sediments to determine the quantity of weakly held metals (copper, lead, and zinc) that have been deposited on the mineral grains from stream water. It is one means of tracing these metals to a source upstream. The results of the heavy metals test (table 1) on 186 stream-sediment samples contain four values greater than 7 ppm. By comparison with the other samples, these four appear to be anomalously high. The localities were revisited and resampled. Sample P110d (32 ppm cxHM) comes from a west tributary of Lion Creek, which flows approximately on the trace of the Redwood fault. This is the same general area of the mining claims near Island Mountain. Presumably the area was prospected when these claims were staked, but no discoveries are known. Three float pebbles of altered rock (P110a, P110b, P110c) were collected at the same locality, but spectrographic analyses did not disclose anomalous metal values in them. No evidence of mineralization along the Redwood fault was noted by us or by Fiedler (1944).

A resampling of the Lion Creek tributary failed to produce stream-sediment samples containing high cxHM values (samples P276a, P277b, P278, P289a, P289b, and P291). Bedrock samples (P275, P276b, and P277a) of sulfide-bearing gneiss collected along the stream did, however, suggest that the gneiss was the source of the metal in the original stream sample. The sulfide-bearing gneiss occurs in numerous layers and lenses along the stream. Spectrographic analyses show that it is slightly high in zinc and copper, and notably high in molybdenum and vanadium.

An anomalous sample (H104) containing 27 ppm cxHM was collected from the mouth of an intermittant stream draining into the Carmel River off the east side of Elephant Mountain, but a resampling of the stream sediments failed to duplicate the initial high cxHM value. As in the Lion Creek area, sulfide-bearing gneisses are present along the lower half mile of the stream. Spectrographic analyses of the gneisses (samples P268 and P273) show slightly high copper contents of 70 and 100 ppm, and an iron-rich spring deposit (sample P267a) contains 500 ppm zinc.

Stream-sediment samples P108 from South Fork Little Sur River and P118a from Doolans Hole Creek containing 9 and 11 ppm cxHM, respectively, are slightly higher than normal. These samples were collected on nearly opposite sides of the divide at the head of Doolans Hole Creek. An altered float pebble (P118b) from Doolans Hole Creek did not contain anomalously high quantities of copper, lead, or zinc. Two samples (P101a and P101b) of altered rock from the drainage divide likewise show only average amounts of metals in the spectrographic analyses. Additional stream-sediment samples from these areas contain average cxHM values. Although no rocks were found in the drainage area represented by these samples that may have contributed to the cxHM values of samples P108 and P118a, it is likely that sulfide-bearing gneisses are present and are the source.

The metal content of some of the sulfide- and graphite-bearing gneisses is comparable to many unmetamorphosed carbonaceous sedimentary rocks (Davidson and Lakin, 1961, 1962; Vine, 1966), and the gross chemistry of the gneisses suggests that they were derived from such sedimentary rocks. Davidson and Lakin (1961) concluded that because of their metal concentrations, some black shales will become ores in the future. Similarly, it is possible that the metalliferous gneisses of the Ventana primitive area might one day be ore, but their grade, in the hundredths of a percent, is presently below ore grade.

LIMESTONE (MARBLE)

Discontinuous layers and pods of recrystallized limestone are widespread in the metamorphic rocks in the primitive area. The layers and pods are small, very difficult to reach, and of variable quality, and there is little likelihood that they could be exploited economically in the foreseeable future. Much larger bodies occur in the same geologic environment 1 to 3 miles west and southwest of the primitive area. These bodies, which have been quarried on a very small scale in the past, are nearer California Highway 1 and hence are more easily accessible and could be mined more cheaply than those in the area.

The largest limestone bodies in the primitive area lie on or near the southwest boundary, in particular on the ridge known as Cabezo Prieto north of Big Sur River. A few others of comparable size are known in the vicinity of Redwood Creek and Lost Valley Creek. The largest bodies found are shown on plate 1; numerous smaller bodies scattered widely through the metamorphic rock are not shown. The many bodies west and southwest of the primitive area that are shown on plate 1 are taken from maps by Trask (1926) and Reiche (1937). Although bedrock outcrop is poor in some parts of the area, it is doubtful that marble bodies larger than those shown on plate 1 are present.

The composition of the marble ranges widely as indicated by the partial analyses in table 2. In general the purer marbles were sampled. Some of the analyzed samples are single specimens chosen to represent a body or part of a body, and others are composite samples collected by taking a chip every 2 to 3 feet across the outcrop. The analyses show that several of the marbles are high in CaO and that if the marble deposits were present in larger quantities they would be satisfactory for most uses. The "remainder" in the analyses consists mostly of SiO_2; 1 percent or less of crystalline graphite is present in most samples.

TABLE 2.—*Partial analyses of marble samples*

[Sample type: S, selected specimen; C, chip sample. Results in percent. Total iron as Fe_2O_3. Remainder, probably mostly SiO_2 not analyzed. P_2O_5 determined by volumetric method by G. D. Shipley; CaO, MgO, and Fe_2O_3, determined by atomic absorbtion method by W. D. Goss; Al_2O_3 determined by colorimetric method by W. D. Goss; CO_2 determined by gasometric method by D. L. Kouba]

Sample	Sample type	P_2O_5	CaO	MgO	Fe_2O_3	Al_2O_3	CO_2	Remainder
P107	S	0.06	55.2	0.48	0.14	0.55	42.5	1.07
P119	S	.12	55.3	.36	.11	.97	42.4	.74
P120	S	.09	54.0	.26	.12	1.29	43.0	1.24
P236	S	.05	30.7	2.08	2.72	1.84	20.3	42.31
P241	S	.03	54.4	.39	.22	.69	42.0	2.27
P245a	S	.10	54.6	1.04	.16	.78	43.4	----------
P245b	S	.12	54.4	.58	.15	.60	43.3	.85
P245c	S	.16	56.4	.41	.15	1.20	42.9	----------
P252	C	.19	46.4	.58	3.52	2.21	36.2	10.9
P254	C	.15	42.4	2.02	4.64	4.6	29.9	16.29
P264	C	.15	50.2	3.28	.11	.97	41.7	3.59
P265	C	.10	53.8	.38	.14	.60	42.8	2.18
P266	C	.10	52.7	1.80	.26	.69	42.1	2.35
H42b	C	.11	50.2	1.76	3.52	2.07	39.2	3.14
H48b	C	.10	49.3	1.14	3.68	2.76	36.1	6.92
H160	S	.06	49.8	.58	2.72	3.22	39.3	4.32
H164	C	.06	15.0	1.00	3.52	10.6	8.68	61.14
H165	S	.04	42.6	.80	2.40	3.50	31.1	19.56
H167	C	.10	33.7	3.20	3.52	4.83	7.72	46.93

One of the larger and most accessible of the high-calcium marble bodies forms the top of Marble Peak. Though not completely exposed, it is probably about 1,000 feet long, less than 500 feet wide, and 150 feet thick at its thickest part. Marble Peak is on a poor road about 12 miles from California Highway 1 and about 45 miles from the nearest railhead at Monterey. A few other bodies, such as the one in Doolans Hole Creek, are similar in size but are more remote and in very rugged terrain.

OIL AND GAS

It is very unlikely that commercial quantities of oil and gas underlie the primitive area. The possibilities are virtually nonexistent wherever pre-Cretaceous crystalline rocks crop out at the surface as they do in a major part of the primitive area. The narrow and isolated bands of sedimintary rock preserved along the Church Creek and Palo Colorado faults also offer virtually no possibility of oil or gas traps. An area of a few square miles south of Lost Valley is underlain by Cretaceous and younger rocks and cannot be dismissed as readily but, nevertheless, offers little promise. Here, there are rocks that could conceivably act as oil and gas reservoir rocks but they are in a very unfavorable structural and topographic position. Several oil fields are present along the Salinas River valley about 20 to 30 miles east and southeast of the primitive area. Wells in these fields apparently all produce from rocks of middle and late Miocene age. Only older rocks are known in the primitive area.

ECONOMIC APPRAISAL

By Paul V. Fillo, U.S. Bureau of Mines

INTRODUCTION

Investigations of mineral occurrence and economic potential in the Ventana primitive area by the U.S. Bureau of Mines consisted of searching the mineral claim location and assessment records in the Monterey County recorder's office and the mineral production records in the Federal files. In addition, a helicopter, under contract to the U.S. Geological Survey, was used to make an air reconnaissance of the area and to drop and pick up field personnel, who conducted examinations on the ground. These on-site inspections of potential mineralized areas were made jointly by Robert C. Pearson, U.S. Geological Survey, and Paul V. Fillo, U.S. Bureau of Mines. The U.S. Forest Service provided information on claims filed before 1938 in and near the primitive area.

MINING CLAIMS

The Monterey County records disclosed two lode claims in the Ventana primitive area in sec. 23, T. 19 S., R. 2 E., and 18 placer claims, all in T. 19 S., R 2 E., Mount Diablo base and meridian. These lode and placer claims were located in the fall of 1931. The descriptions of these claims, given in the location notices, were vague and the workings could not be recognized because of dense vegetation covering the area.

No record of mineral production from the Ventana primitive area was found in the Federal files. No current assessment work was recorded in the county records and no Federal oil and gas leasing activity had been established in the primitive area.

CONCLUSIONS

Investigation of the Ventana primitive area by the Bureau of Mines did not disclose any exploitable mineral occurrences, and none were found as a result of the Geological Survey field examination.

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