DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY


Base from U.S. Geological Survey, 1:24,000:
Guaje Mountain, 1952; Polvadera Peak, 1953;
Vallecitos, 1953; Valle Toledo, 1952; Bland,
1952; Abiquiu, 1953; Canones, 1953;
Frijoles, 1952

Geology from Smith and others (1970).
Modified by Kim Manley, 1981

SCALE 1:62 500
1 ½ 0 1 2 3 4 MILES
1 .5 0 1 2 3 4 KILOMETERS
CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

# MINERAL RESOURCE POTENTIAL AND GEOLOGIC MAP OF THE CABALLO AND POLVADERA ROADLESS AREAS, LOS ALAMOS AND RIO ARRIBA COUNTIES, NEW MEXICO


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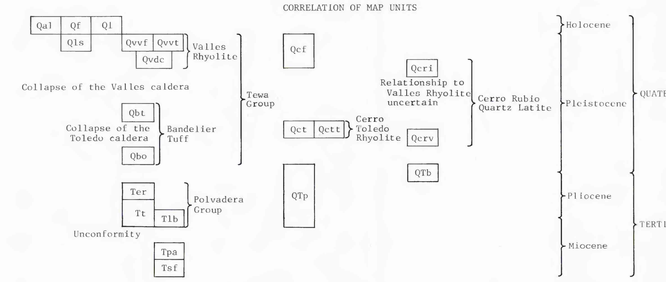
1983

MISCELLANEOUS FIELD STUDIES
MAP MF-1516
PAMPHLET ACCOMPANIES MAP

CORRELATION OF MAP UNITS




## DESCRIPTION OF MAP UNITS

Qal ALLUVIUM (HOLOCENE)--Silt, sand, and gravel; mainly deposits of recent streams. As thick as about 100 ft

Qf FAN DEPOSITS (HOLOCENE)--Coarse sand and gravel; mainly deposits of transient streams having steep gradients. As thick as about 100 ft

Ql LANDSLIDE DEPOSITS (HOLOCENE)--As thick as about 150 ft

Qls TUFFACEOUS LAKE SEDIMENTS (PLEISTOCENE)--Thin-bedded clay, silt, and sand deposited in lakes within the Valles caldera west of the Caballo Roadless Area; commonly contain fossil leaf and other plant remains; interbedded with tuffs of the Valle Grande Member of the Valles Rhyolite. As thick as about 100 ft

VALLES RHYOLITE (PLEISTOCENE)
Valle Grande Member

Qvvf Volcanic domes and flows--Predominantly porphyritic rhyolites; contains major phenocrysts of quartz and sanidine, and lesser plagioclase, biotite, hornblende, and pyroxene. Thickness 200-2,500 ft

Qvvt Bedded rhyolite tuffs and tuff breccias. Thickness 0 to approximately 500 ft

Qvdc Deer Canyon Member--Rhyolite dome-flow, associated breccias, and bedded tuffs. Predominantly coarsely porphyritic, lithoidal rhyolite typically containing abundant phenocrysts of sanidine and bipyramidal quartz. Thickness 25-100 ft

Qcf CALDERA FILL (PLEISTOCENE)--Coarse breccia, gravel, sand, and silt deposited within the Valles caldera. Predominantly volcanic detritus but locally contains large blocks of Paleozoic limestone and red sandstone. Some coarse breccia units represent landslide deposits from caldera walls. Includes early formed caldera lake sediments and some pyroclastic deposits. As thick as 2,500 ft

CERRO RUBIO QUARTZ LATITE (PLEISTOCENE)

Qcri Shallow intrusion--Medium- to light-gray biotite-hornblende-quartz latite

Qcrv Volcanic dome--Red to gray biotite-hornblende-quartz latite

BANDELIER TUFF (PLEISTOCENE)--Predominantly non-welded to densely welded ash-flow deposits consisting of rhyolite ash and pumice; typically contains bipyramidal quartz and chatoyant sanidine phenocrysts. Thickness approximately 30-900 ft

Qbt Tshirege Member--Nonwelded to densely welded ash-flow tuffs; characteristically contains sparse to abundant cognate(?) inclusions of hornblende-rich quartz-latite pumice, and sparse accidental lithic inclusions. Includes 1-4 m of basal, bedded, air-fall pumice (Tsankawi Pumice Bed). Thickness approximately 50-900 ft

Qbo Otowi Member--Nonwelded to densely welded ash-flow tuffs; characteristically contains abundant accidental lithic inclusions. As mapped, includes as much as 30 ft of basal, bedded, air-fall pumice (Guaje Pumice Bed). As thick as about 600 ft

CERRO TOLEDO RHYOLITE (PLEISTOCENE)

Qct Volcanic domes--Mainly gray lithoidal rhyolite, commonly lithophysal, and subordinate obsidian, containing small sanidine and rare quartz phenocrysts

Qctt Rhyolite tuffs and tuff breccias--Includes hot-avalanche deposits from the Rabbit Mountain center. As thick as about 200 ft

QTb BASALTIC LAVAS AND TUFFS OF EL ALTO (PLEISTOCENE AND PLIOCENE)--Olivine-augite basalt flows and cinders; commonly contains quartz xenocrysts. As thick as 1,500 ft

QTp PUYE FORMATION (PLEISTOCENE(?), PLIOCENE, AND MIOCENE)--Conglomerate and coarse sand containing numerous interlayered lithic lapilli tuff beds and lahar deposits. Composed predominantly of dacite, rhyodacite, and quartz latite debris derived from contemporaneous erosion and volcanism of the Tschicoma Formation (unit Tt). Basal Totavi Lentil (0-80 ft thick), not separately mapped, consists of well-rounded boulders and cobbles of Precambrian quartzites and crystalline rocks; probably channel gravel of the ancestral Rio Grande. Thickness 50-700 ft

QTer EL RECHUELOS RHYOLITE (PLIOCENE)--Volcanic domes and a single small pumice cone. Pumice, perlite, and obsidian, containing rare, small quartz and sanidine phenocrysts. Largest dome approximately 400 ft high

Tt TSCHICOMA FORMATION (PLIOCENE AND UPPER MIOCENE)--Predominantly coarsely porphyritic dacite, rhyodacite, and quartz latite; contains pyroxene, hornblende, biotite, plagioclase, and some quartz phenocrysts. Thick, massive flows and domes. Associated pyroclastic rocks mapped as part of the Puye Formation (QTp). As thick as 3,000 ft

Tlb LOBATO BASALT (PLIOCENE AND UPPER MIOCENE)--Olivine-augite and titaniferous augite basalts; commonly contains quartz xenocrysts; predominantly flows. As thick as 600 ft

Tpa PALIZA CANYON FORMATION (MIOCENE)--Mainly hypersthene-augite andesites and subordinate olivine-bearing basaltic andesites. Flows, flow breccias, tuff breccias, and dikes, undivided. As thick as about 2,000 ft

Tsf SANTA FE FORMATION (MIOCENE)--Poorly consolidated buff, red, or gray arkosic sand, silt, clay, and pebble beds, and minor thin, white or green ash beds. As thick as about 5,000 ft

APPROXIMATE BOUNDARY OF STUDY AREAS

CONTACT

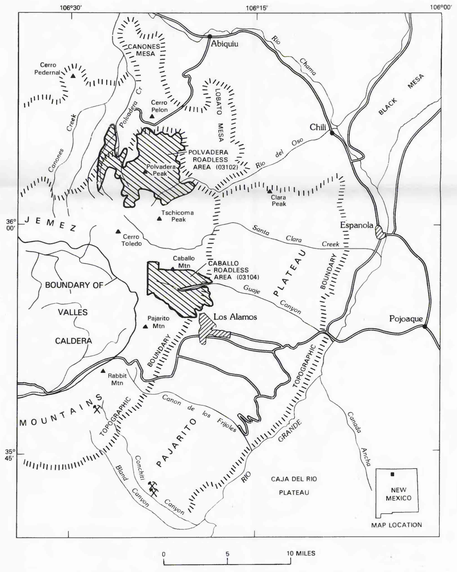
FAULT--Dashed where approximately located; dotted where concealed. Bar and ball on downthrown side

SAMPLE LOCALITY

•P23 Stream sediment--U.S. Geological Survey

OA Rock--U.S. Bureau of Mines

GEOTHERMAL LEASE AREA




INDEX MAP SHOWING THE LOCATION OF THE CABALLO AND POLVADERA ROADLESS AREAS, NORTH-CENTRAL NEW MEXICO

## STUDIES RELATED TO WILDERNESS

The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts require the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas on Federal lands to determine their mineral resource potential. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral resource potential survey of the Caballo and Polvadera Roadless Areas in the Santa Fe National Forest, Los Alamos and Rio Arriba Counties, New Mexico. The Caballo (03104) and Polvadera (03102) Roadless Areas were classified as further planning areas during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

## SUMMARY


A mineral resource potential study was conducted for the Caballo and Polvadera Roadless Areas, Los Alamos and Rio Arriba Counties, New Mexico, in 1980. These areas, consisting of 24,280 acres in the Jemez Mountains, are in the Santa Fe National Forest north of Los Alamos. The rocks in the areas studied are mainly volcanic, with minor volcaniclastic sedimentary rocks.

The mineral resource potential is low. There has been no mining activity within the study areas, and chemical analyses of stream-sediment samples show no significant anomalous concentrations of metal elements. Near the Polvadera area there has been some exploration for geothermal resources.


## INTRODUCTION

The Caballo and Polvadera Roadless Areas, in the Santa Fe National Forest, northern New Mexico (fig. 1), were studied in 1980 to determine their mineral resource potential. The Caballo area, consisting of 8,800 acres (3,563 ha), is in the northwestern part of Los Alamos County near the town of Los Alamos. The Polvadera area, consisting of 15,480 acres (8,267 ha), is in Rio Arriba County about 6 mi (9.6 km) north of the Caballo area.

The roadless areas are in the Jemez Mountains, an isolated mountain range in north-central New Mexico, and are, in large part, heavily timbered and dissected by several steep-walled canyons that contain perennial streams. Elevations range from 7,300 to 11,232 ft (2,225 to 3,426 m). The Jemez Mountains are remnants of a large, complex volcanic field that was active between 0.5 and 12 m.y. ago. Rocks in the study areas are chiefly mafic to felsic domes and flows, ash-flow tuffs, and volcaniclastic rocks derived from the volcanic highlands.

The Jemez Mountains have been the focus of extensive investigations by R. L. Smith and his colleagues in the U.S. Geological Survey. Their geologic map of the area (Smith and others, 1970) and a report on the stratigraphic nomenclature (Bailey and others, 1968) were used without reservation in preparing this report and map, although age designations for rock units have been changed to conform with currently accepted boundaries of the Miocene-Pliocene at 5 m.y. and Pliocene-Quaternary at 2 m.y. or have been changed where additional radiometric ages are available. Additional geologic data in the Los Alamos area are from Griggs (1964).

No mining activity has taken place within the study areas. Nearby mining activity includes pumice and diatomaceous earth operations 11 mi (18 km) to the east, and the Bland or Cochiti mining district 12 mi (20 km) to the south, where gold, silver, lead, and copper were produced from volcanic rocks of the Jemez volcanic field between 1894 and 1948 (Elston, 1967).

## GEOLOGY AND GEOCHEMISTRY

The Jemez Mountains volcanic field overlies sedimentary rocks of Permian to Miocene age along the western margin of the Rio Grande rift. The volcanic rocks have been subdivided into three groups (Bailey and others, 1969); the Keres, Polvadera, and Tewa Groups. The oldest group, the late Miocene Keres, is exposed primarily in the southern part of the volcanic field outside the map area but includes one formation, the Paliza Canyon Formation, which is exposed in the southwestern part of the map area.

Most of the rocks in the study areas belong to the Tschicoma Formation of the late Miocene to Pliocene Polvadera Group. The rocks of this formation are predominantly dacitic to quartz latitic. Also included within the Polvadera Group is the El Rechuelos Rhyolite, represented by three small domes in the Polvadera area, and the lava flows of the Lobato Basalt, which are exposed north and northeast of the Polvadera area.

The Puye Formation, a sedimentary sequence in part contemporaneous with the Polvadera Group, is exposed locally along the east sides of the study areas. It is composed of detrital material derived chiefly from the concurrent erosion of the Tschicoma Formation.

Rocks of the younger, Quaternary Tewa Group include many rhyolites and ash-flow tuffs that represent the terminal stages of volcanism in the Jemez Mountains. These rocks record the formation of two calderas, the Toledo and Valles, which largely overlap one another, and the subsequent intracaldera domes. Rocks from this group are exposed in parts of the margins of the areas and contribute abundant quartz and sanidine phenocrysts to the stream sediments.

In 1980 the Caballo and Polvadera areas were assessed for mineral resource potential. Although no additional geologic mapping or geophysical surveys were considered necessary, a geochemical stream-sediment investigation was conducted. Fifteen stream-sediment samples were collected from major drainages in the Caballo Roadless Area and twenty-six from the Polvadera Roadless Area. The maximum concentrations for some metals are shown in table 1.

Samples having values of 5-10 ppm molybdenum cluster in the South and West Forks of Polvadera Creek (samples P13, P16-P19). The weakly anomalous molybdenum, tin, and lead values in a few samples probably reflect intrinsically high metal concentrations in some of the late rhyolitic rocks and are not considered significant.

Table 1.--Maximum metal concentrations for some elements in stream-sediment samples from the Caballo and Polvadera Roadless Areas

[Samples were sieved to <2 mm (sand and clay) in the field and analyzed by the U.S. Geological Survey, using semi-quantitative spectrographic methods, for Fe, Mg, Ca, Ti, Mn, Ag, As, Au, B, Ba, Be, Bi, Cd, Co, Cr, Cu, La, Mo, Nb, Ni, Pb, Sb, Sc, Sn, Sr, V, W, Y, Zn, Zr, and Th. Analyses showed no significant anomalous concentrations of metals]

| Sample No. | Element | Concentration (ppm) | Level of detection (ppm) |
|---|---|---|---|
| P25-------- | Cu | 30 | 5 |
| C15, P13, P17, P18. | Mo | 10 | 5 |
| C2--------- | Pb | 150 | 10 |
| P17-------- | Sn | 10 | 10 |
| C15-------- | Zn | 200 | 200 |

## MINING DISTRICTS AND MINERALIZATION

No mining districts are within the two areas studied. Courthouse records were examined at Los Alamos (Los Alamos County) and Tierra Amarilla (Rio Arriba County), and no claim records were found. There are no known mineralized areas within the roadless areas.

There has been some interest in geothermal resources near the Polvadera area. AMAX Exploration Inc. has drilled eight geothermal holes near the southwest part of the area, and several geothermal leases extend into the study area.

## ASSESSMENT OF MINERAL RESOURCE POTENTIAL

The potential for mineral resources in the Caballo and Polvadera Roadless Areas is considered low. The Jemez Mountains volcanic field is probably a bimodal volcanic center, but values of the commonly associated metals, beryllium, molybdenum, tin, and possibly silver and gold, are not anomalous in the study areas. Base metals are not a likely association in these areas. A slight concentration of a maximum of 10 ppm molydenum is present in samples from the west edge of the Polvadera area.

## REFERENCES


Bailey, R. A., Smith, R. L., and Ross, C. S., 1968, Stratigraphic nomenclature of volcanic rocks in the Jemez Mountains, New Mexico: U.S. Geological Survey Bulletin 1274-P, 19 p.

Elston, W. E., 1967, Summary of the mineral resources of Bernalillo, Sandoval, and Santa Fe Counties, New Mexico (exclusive of oil and gas): New Mexico Bureau of Mines and Mineral Resources Bulletin 81, 81 p.

Griggs, R. L., 1964, Geology and ground-water resources of the Los Alamos area, New Mexico, with a section on Quality of water, by J. D. Hem: U.S. Geological Survey Water-Supply Paper 1753, 107 p.

Smith, R. L., Bailey, R. A., and Ross, C. S., 1970, Geologic map of the Jemez Mountains, New Mexico: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-571, scale 1:250,000.



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