New Mexico Bureau of Geology and Mineral Resources
Socorro, New Mexico
Information: 505-835-5420
Publications: 505-83-5490
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A Division of
New Mexico Institute of Mining and Technology

Dear "Rockhound"

Thank you for your interest in mineral collecting in New Mexico. The New Mexico Bureau of Geology and Mineral Resources has put together this packet of material (we call it our "Rockhound Guide") that we hope will be useful to you. This information is designed to direct people to localities where they may collect specimens and also to give them some brief information about the area. These sites have been chosen because they may be reached by passenger car. We hope the information included here will lead to many enjoyable hours of collecting minerals in the "Land of Enchantment." Enjoy your excursion, but please follow these basic rules:

Take only what you need for your own collection, leave what you can't use.

Keep New Mexico beautiful. If you pack it in, **pack it out**.

Respect the rights of landowners and lessees. Make sure you have permission to collect on private land, including mines.

Be **extremely careful** around old mines, especially mine shafts.

Respect the desert climate. Carry plenty of water for yourself and your vehicle. Be aware of flash-flooding hazards.

The New Mexico Bureau of Geology and Mineral Resources has a whole series of publications to assist in the exploration for mineral resources in New Mexico. These publications are reasonably priced at about the cost of printing.

New Mexico State Bureau of Geology and Mineral Resources Bulletin 87, "Mineral and Water Resources of New Mexico," describes the important mineral deposits of all types, as presently known in the state. This should be of assistance to anyone desiring to prospect for minerals in New Mexico.

The New Mexico Bureau of Geology and Mineral Resources has prepared twelve bibliographies of New Mexico geology and technology. These publications are Bulletin 43 covering up through 1950; Bulletin 52 for 1951-1955; Bulletin 74 for 1956-60; Bulletin 90 for 1961-65; Bulletin 99 for 1966-1970; Bulletin 106 for 1971-75; Bulletin 109 for 1976-80; Bulletin 110 for 1981-83; Bulletin 120 for 1984; Bulletin 123 for 1985; Bulletin 130 for 1986; and Bulletin 151 for 1987.

In addition to the general coverage in the above mentioned bulletins there are also publications dealing more completely with more specific locations. These can be of great assistance to the prospector. Upon request a complete list of publications is available from the publications office. They also have the geologic and topographic map coverage that is available for the state.

We would also like to recommend the following books:

A comprehensive catalog of mineral occurrences in New Mexico is Minerals of New Mexico, by Stuart Northop, 3rd edition, revised by Florence A. LaBruzza, University of New Mexico Press, Albuquerque, NM 87131.

For those of you who would like a general book on minerals for the layman we recommend: Field Guide to Rocks and Minerals, by Fredrick Pough, published by Houghton Mifflin Company, Boston. This is available at most bookstores in hardbound and paperback. Also, Rocks and Minerals by Charles Sorrell, published by Western Publishing Co., New York.

Another excellent field guide with many high-quality color photos is the Audubon Society Field Guide to North American Rocks and Minerals, published by Alfred A. Knopf, Inc., New York. This book is available in most bookstores in softbound form.

Gems, Minerals, Crystals and Ores, by Richard M. Pearl, published by Western Publishers, New York, is an informative general book with good photography.

For the more advanced, serious collector Dana's Manual of Mineralogy, by C.S. Hurlburt and C. Klein, published by John Wiley and Sons, New York, could be of interest.

Handbook for Prospectors, by Richard M. Pearl, published by McGraw-Hill, New York, is a good starting point for new mineral collectors.

For those interested in fossils, the following may be of interest:

Fossils for Amateurs, by R.P. MacFall and Jay Wollin, published by Van Nostrand and Reinhold, New York. Paperback.

Invertebrate Fossils, by Raymond C. Moore, Cecil C. Lalicker, and Alfred G. Fischer, published by McGraw-Hill, New York. This is a good introductory for college text with many line drawings that will help amateurs identify their finds.

Life of the Past, by N. Gary Lane, published by Merrill Publishing Co., Columbus, Ohio.

Evolution of the Vertebrates: A History of the Backboned Animals Through Time, by Edwin H. Colbert, published by John Wiley and Sons, New York. Although collecting vertebrates on state and federal land requires special permits, this book will interest the fossil collector curious about early mammals, fish, amphibians, and reptiles (including the dinosaurs).

A general book on fossils for the layman is The Fossil Book, by Fenton and Fenton, published by Doubleday, New York.

There are a number of mineral and fossil displays throughout the state. The largest are the New Mexico Bureau of Geology and Mineral Resources Mineral Museum – now in a new location on the campus of New Mexico Tech in Socorro, the Geology Department displays in Northrop Hall at the University of New Mexico in Albuquerque, and the New Mexico Museum of Natural History's and Science's selected displays in Albuquerque.

There is no single, simple procedure for gaining access to localities on all classes of land in New Mexico. Federally owned lands (BLM, National Forest) are open to collecting in most cases, except in national parks and monuments. Land administration and mineral ownership maps are available from the Bureau of Land Management, PO Box 1449, Santa Fe, NM 87501. Entry to state lands requires a lease agreement. Information regarding state lands is available from the State Lands Office, PO Box 1148, Santa Fe, NM 87501. Permission of the landowner is required on private lands (including mine properties and Indian land). Arrangements for entry must be obtained for the collector from the property owner. Collecting from underground mine workings is **EXTREMELY HAZARDOUS** and definitely not recommended. But the mine dumps usually contain a good representation of the available minerals and are the principal sources of specimens for the collector. Rock Hound State Park, a few miles southeast of Deming, has been specifically set aside for the use of rock and mineral collectors.

We've also included a list of New Mexico rock and mineral societies/clubs and a list of some of the many mineral and rock dealers in the state. The mineral/rock dealers carry local mineral specimens, and may have additional information on collecting area. Check the phone directory of the towns you visit for other dealers who may not be included in this list. If you have specific questions on mines and minerals of New Mexico, you may wish to contact:

Virgil Lueth, Mineralogist
New Mexico Bureau of Geology and Mineral Resources
New Mexico Tech
801 Leroy Place
Socorro, NM 87801-4796

We hope you enjoy the beautiful scenery, fresh air, and charm of New Mexico. And, we wish you good luck in your collecting. If we can be of further assistance, please feel free to contact us.

Sincerely,

Dr. Peter A. Scholle
Director/State Geologist
NM Bureau of Geology and Mineral Resources

A List of New Mexico Rock & Mineral Societies/Clubs
Prepared by: Virgil W. Lueth, Mineralogist/Economic Geologist (6/02)

Albuquerque Gem & Mineral Club
PO box 13718
Albuquerque, NM 87192
Meet: 7:30 p.m., 4th Monday of ea. Month
NM Museum of Natural History

Carlsbad Roadrunners Gem & Mineral Club
PO box 1023
Carlsbad, NM 88220
Meet: 7:00 p.m., 1st Monday of ea. Month
Senior Center 1112, No. Mesa St.

Deming Gem & Mineral Society
PO Box 1459
Deming, NM 88031
Meet: 7:30 p.m., 4th Thurs of ea. Month
109 E. Pine St., - Morgan Hall

Lea Lap Rock & Mineral Club
PO Box 1065
Hobbs, NM 88241
Meet: 7:30 p.m. 4th Thurs of ea. Month
Pioneer State Trust, 202 N. Turner

Lordsburg Gem & Mineral Society
PO Box 521
Lordsburg, NM 88045
Meet: 7:30 p.m., 3rd Tues. of ea. Month
Armory on 2nd St.

Rio Rancho Rockhounds
309 San Juan de Rio
Rio Rancho, NM 87124
Meet: 7:00 p.m., 1st Tues. of ea. Month
Meadowlark Senior Center
4330 Meadowlark Lane

Grant County Rolling Stones
PO Box 1555
Silver City, NM 88062
Meet: 7:00 p.m., 2nd Thurs. of ea. Month
University Lapidary Lab, WNMU

The New Mexico Faceters Guide
6800 Luella Anne NE
Albuquerque, NM 87109
Meet: 7:30 p.m., 2nd Thurs. of ea. Month
NM Museum of Natural History

Clovis Gem & Mineral Society
PO Box 1815
Clovis, NM 88102
Meet: 7:30 p.m., 3rd Monday of ea. Month
Various Locations

San Juan County Gem & Mineral Society
PO Box 1482
Farmington, NM 87401
Meet: 7:30 p.m., 4th Friday of ea. Month
Room 189, Breland Hall, NMSU

Gemcrafters & Explorers Club
PO Box 4284, University Station
Las Cruces, NM 88005
Meet: 7:30 p.m. 3rd Friday of ea. Month
Room 189, Breland Hall, NMSU

Los Alamos Geological Society
PO Box 762
Los Alamos, NM 87544
Meet: 7:30 p.m., 3rd Tues. of ea. Month
Fuller Lodge, Rm. 115

Chaparral Rockhounds
PO Box 815
Roswell, NM 88202
Meet: 7:30 p.m., 3rd Thurs. of ea. Month
Rec Center, 807 Missouri

Sierra Rock Club
206 Fur St.
Truth or Consequences, NM 87901
Meet: 7:30 p.m., 1st Mon. of ea. Month
DAV Chapter # 11 Hall

ROADLOG FROM
ALBUQUERQUE TO SOCORRO VIA I-25

Virginia T. McLemore
New Mexico Bureau of Mines and Mineral Resources
Socorro, NM 87801

Assembly Point: Albuquerque International Airport
Distance: 73.4 miles

Use of Roadlog

The following roadlog describes the general geology and physiography from Albuquerque International Airport, southward, to Socorro (Fig. 1). This entire trip is on paved roads. Many features can be seen while driving, but please do not try to read the roadlog while driving. Have a passenger read the log or pull over in a safe place to read and observe. "Where to look" is usually given in clock-face terminology: 12:00 is straight ahead, 9:00 is due left, and 3:00 is due right.

This roadlog was written primarily for the 24th annual meeting of the Clay Mineral Society held in Socorro, New Mexico, October 19-22, 1987. With permission, I have drawn freely on appropriate parts of published roadlogs and descriptions by Chapin et al. (1978), Hawley (1978a), Lambert (1978), Hawley et al. (1982), and Chamberlin et al. (1983). The English translation of Spanish geographic names is given in parentheses. For more specific information about the geology of Albuquerque and Socorro areas the reader is referred to Northrop (1961), Kuellmer (1963), Hawley (1978b), Wells et al. (1982), Chapin (1983), and Kelley (1982).

Summary

The tour route passes through the Albuquerque and the Socorro Basins of the Rio Grande valley. The Rio Grande rift, part of which is traversed by this tour, has been the topic of much controversy and study. It is beyond the scope of this roadlog to include that data. However, the reader will find this to be a useful generalized guide to the Cenozoic geology and physiography of the central part of the rift.

The Rio Grande (Great River) did not erode the great depression it follows except in a minor way. Instead the depression, called a graben or rift, was formed as an elongated unit bounded on both sides by faults. The Rio Grande rift is a result of pulling apart of the earth's crust thereby causing the center to drop in elevation forming the depression. The river follows this depression and actually deposits sediment along its course attempting to fill the great depression. Much of the sedimentary rock seen along the route from Albuquerque to Socorro represent this type of basin fill. Geophysical evidence and oil tests suggest that the depth of basin-fill sediments in the Rio Grande is about 20,000 ft.

Volcanic activity is common along rifts, including the Rio Grande rift. Hot molten material from the mantle travels along the rift-bounding faults forming volcanoes and basaltic eruptions. Very few cities in the world have as many extinct volcanoes nearby as Albuquerque. The Albuquerque volcanoes are only 7 miles from downtown, on the western skyline as one leaves the airport. Canjilon and San Felipe Pueblo volcanoes are only 20-30 miles upriver; Isleta Pueblo and Los Lunas volcanoes are only 12-20 miles downriver on the way to Socorro. The Jemez caldera is 60 miles to the north and can be seen from the airport on a clear day. To the west, about 50 miles past the Albuquerque volcanoes, lies Mt. Taylor reaching an elevation of 11,301 ft. In all, about 270 volcanoes or stumps occur within 65 miles of Albuquerque (Kelley, 1982). We will see a few on the way to Socorro.

Mileage

0.0	Leave Albuquerque International Airport; turn right onto Yale Blvd. The city of Albuquerque is straight ahead (due north). Albuquerque (originally spelled Alburquerque) was founded in 1706 by the colonial governor Don Francisco Cuervo y Valdez in honor of the Duque de Alburquerque, the 34th Viceroy of New Spain (Pearce, 1965). The Rio Grande, to the west, divides the city into two. The elevation of the river bed near the downtown section is about 4,900 ft. To the west (left), the land rises through low lands and gradual slopes to the mesa on the western skyline, Llano de Albuquerque, about 5,800 to 6,000 ft above sea level and about 8 to 12 miles from downtown Albuquerque. The magnificent eastern escarpment, the Sandia Mountains (Watermelon Mountains), rises to over 10,000 ft. Sandia Crest is the highest point at an elevation of 10,678 ft. Sandia Peak Tramway, the world's longest, spans 2.7 miles from the foothills to the Crest. **0.2**
0.2	Traffic light at junction of Randolph and Yale. Keep straight on Yale. **0.4**
0.6	Turn left at junction of Yale and Gibson Blvd. At about 2:00, five small cones rise above the Llano de Albuquerque. These cones are the Albuquerque volcanoes and form a north-south line. The highest volcano, Vulcan, is at an altitude of 6,033 ft. The volcanoes are about 500,000 to 1,000,000 years old and have been extinct for about 250,000 years (Kelley, 1982). All of the volcanoes erupted basaltic lavas. **0.8**
1.4	Traffic light at University Ave. Keep straight on Gibson. **0.4**
1.8	Underpass to I-25. **0.1**
1.9	Turn left onto ramp to I-25 south. **1.0**
2.9	Milepost 222. Route ahead is on a Holocene alluvial-fan apron extending westward from the base of the escarpment (9:00 to 11:00) that forms the outer rim of the Rio Grand valley. The escarpment ascends to a nearly level surface that is a remnant of the ancient Albuquerque Basin floor (sunport

geomorphic surface of Lambert, 1968; Airport surface of Kelley, 1977). The slopes to the east are cut on upper Santa Fe sediments that are capped by a strong zone of soil-carbonate accumulation (caliche). Lambert (1968) originally included these beds in the Santa Fe Formation-Upper Buff member of Bryan and McCann (1937). Kelley (1977) proposed the term Ceja Member to designate the upper gravelly part of the Upper Buff member and he mapped the beds in this area as part of the Ceja unit. The Ceja Member in the Sunport area is primarily sand and siliceous gravel, with some pebbles derived from source areas north of the Albuquerque Basin (e.g., pumice and obsidian). Local lenses of lacustrine clay, mud, and sand are also present, and sets of cross-strata dip mainly southeast to southwest. These features suggest that the Ceja sediments beneath the Sunport accumulated in a basin-floor environment and represent a mixture of channel and overbank deposits of the ancestral Rio Grande. **1.0**

3.9 Milepost 221. Hills ahead on left are underlain by Ceja Member. Isleta volcano at 2:00. **0.5**

4.4 Crossing Rio Bravo Blvd. Large bodies of clean channel sand and gravel in the Ceja Member-fluvial facies are exposed in hillslopes to the left. **0.3**

4.7 Roadcut in Ceja Member. **0.4**

5.1 Begin descent into valley of Tijeras Arroyo. The large Tijeras drainage basin includes the Precambrian and Paleozoic terranes in the Sandia and Manzanita (little) Mountains. **0.3**

5.4 Crossing railroad spur. Walls of the lower Tijeras Arroyo valley are underlain by ancestral-river (fluvial) facies of the Ceja Member. Early Pleistocene-Late Pliocene vertebrate fossils have been collected from Ceja sediments on the southern side of the arroyo near the top of the scarp at 9:00. This mammalian fauna of late Blancan provincial age includes horse and camel remains (Lambert, 1968; Tedford, 1981). **0.5**

5.9 Milepost 219. Bridge over Tijeras Arroyo. **0.6**

6.5 Underpass. Roadcuts ahead in Ceja Member. **0.8**

7.3 Route descends valley-border scarp to Holocene alluvial-fan apron graded to the approximate level of the present floodplain. **0.6**

7.9 Milepost 217. Magdalena Mountains (west of Socorro) on the distant skyline at 12:30, Ladron Mountains at 12:30, and Isleta volcanic center (Parea Mesa) at 1:30 across the Rio Grande floodplain. **1.0**

8.9 Milepost 216. South Broadway (NM-47) interchange ahead. **Continue on I-25 southbound. 1.1**

10.0 Crossing mainline AT&SF railroad; Rio Grande floodplain ahead. Crops grown along the Rio Grande include corn, alfalfa, chili, melons, onions, blue corn, wheat, barley, soybeans, and grapes. **0.3**

10.3 Crossing Rio Grande floodway and channel. **0.6**

10.9 Crossing Isleta Blvd. Entering Isleta Indian Reservation. Large roadcut ahead through "Black Mesa" (of Isleta); gravel and sand of the upper Santa Fe Group fluvial facies (probable Ceja Member) is capped with "beheaded" basalt flow that has no outcrop connection with Isleta volcano. A buried vent is suspected in the floodplain to the south (Kelley et al., 1976).

Isleta volcano at 11:00 is a compound volcano with a broad cone, 1.2 mi in diameter and 29 ft high, constructed by five basalt flows (Kelley and Kudo, 1978). The basalts have alkali olivine affinities. The base of the volcano is within an earlier maar crater that is almost completely buried except on the northeastern and eastern sides. Basal flow units rest on a maar accumulation of basalt tuff and tuff-breccia. There are also several outlying basalt flows with no exposed connection with the Isleta center. The lowermost flows of the volcano may have been part of a lava lake that erupted in the maar. The second flow above the maar has a K-Ar age of 2.78 $\pm$ 0.12 m.y. (Kudo et al., 1977). **0.6**

11.5 Overpass. In roadcuts to left and right, sand and gravel of the ancestral Rio Grande interfinger westward with basaltic tuff emplaced during early development of Isleta maar (Kelley and Kudo, 1978). **0.5**

12.0 Crossing Coors Road. Basalt of Black Mesa overlies tuff in cuts ahead. **0.4**

12.4 End of basalt tongue in tuffs of Isleta maar is exposed in gullied slope to right. **0.3**

12.7 Milepost 212. Contact of basal basalt flow (lava-lake unit) on tuffs of maar ring exposed in valley wall to right. Note intratuff unconformity with tuff and breccia of Isleta maar on truncated, flat-lying tuffs deposited outside the crater. For the next 0.4 mil, thin upper Santa Fe and valley-slope deposits mantle the basal blow. **1.0**

13.7 Cuts for next 0.3 mi lower flow sequence (Late Pliocene) over tuff of Isleta maar. **0.5**

14.2 Outlying basalt exposed in cut to right. Site of the 21,266 ft deep Shell No. 2 Isleta oil test completed 5/30/80 is located about 1.5 mi west of the volcanic center. The well is reported to have penetrated only Cenozoic units. New housing section of Isleta Pueblo on high terrace at 10:00. Main community with historic church and plaza is about 1.5 mi to the east on a basalt-capped bench above the Rio Grande floodplain. **0.5**

14.7 Exit 209. Isleta Pueblo interchange. **Continue south on I-25.** Route for next 7 mi is on river terrace that is about 140 ft above floodplain level. This surface probably is correlative with the late Pleistocene, Segundo Alto (University of Albuquerque) surface of Lambert (1968). **0.2**

14.9 Overpass. Panoramic view from east to west across the southern Albuquerque Basin includes: Cerro de los Lunas andesitic volcanic center at 1:00, Mesa Lucero on distant skyline at 2:00-2:30, Cat Hill basalt flows and cinder cones at 2:30, and Wind Mesa basaltic andesites at 3:00.

The broad piedmont plain extending westward from the base of the Manzanita-Manzano range (8:00-11:00) is a Llano de Manzano. The north-south-trending break in slope from 8:00 to 10:00, midway up the Llano, is the scarp of the Hubbel Springs fault. The scarp marks the western edge of the Joyita-Hubbell bench of Kelley (1977) and the eastern margin of the deep southern segment of the Albuquerque Basin. **1.0**

15.9 Milepost 209. Crossing bridge over AT&SF railroad ahead. Manzanita and Manzano Mountains due east. **1.5**

17.4 Entering Valencia County. **0.5**

17.9 Milepost 207. Basalt flow in broad swale on 140 ft terrace surface to right. This is the oldest of four flows from the Cat Hills center (Kelley and Kudo, 1978) and has a K-Ar age of 140,000 ± 38,000 years (Kudo et al., 1977). **1.0**

18.9 Milepost 206. The 16,345 ft-deep Shell NO. 1 Isleta Central oil test is located about 2 mi to the west. **1.0**

19.9 Milepost 205. Leaving Isleta Indian Reservation. Grasslands sod farm on right. **1.6**

21.5 Los Lunas exit. **1.1**

22.6 Los Lunas Penitentiary on the left. Note large landslide masses on south side of Los Lunas volcanic center to right. The route ahead descends from a dissected, late Pleistocene river terrace to a low-lying alluvial slope graded to near present floodplain level and underlain by valley fill of Holocene age. The route from here to the Rio Puerco-Rio Grande confluence is mainly on such low valley-border surfaces.

About 1 mi east of this point is the Harlan and others No. 1 exploratory well. Kelley (1977, table 9) reports that the base of the Santa Fe in this 4,223-ft test hole is 2,835 ft below the floodplain surface. **0.3**

22.9 Milepost 201. El Cerro Tome across valley at 9:00 is a small andesitic volcanic center. Bachman and Mehnert (1978, no. 14) have dated a plug from this center at 3.4 ± 0.4 m.y. using K-Ar methods. **4.4**

27.3 Exit 195; north Belen interchange overpass ahead. Belen was named for the Nuestra Señora de Belen (Our Lady of Bethlehem) Grant (Pearce, 1965). From here to Bernardo (mile 49.3) the route skirts the base of the western Llano de Albuquerque escarpment. The summit of this narrow 65-mi mesa is a remnant of the central plain of the Albuquerque Basin. The basic surface formed prior to the entrenchment of the Rio Grande and Rio Puerco valleys. The original piedmont-slope and basin-floor components that made up this ancient plain have been faulted, dissected by erosion, and partly buried by local basalts as well as by eolian and local alluvial-colluvial deposits. All this considered, the broader summit areas of the Llano de Albuquerque, up to 8 mi wide, are probably not aggraded or degraded significantly above or below the original (upper Santa Fe) constructional surface of the plain. The Llano is therefore similar in most respects to the extensive constructional plains of intermontane basins that may be seen south of Socorro. **1.2**

28.5 Cut on right in well-bedded sands to loams and clays of the upper Santa Fe Group (Formation). The entire 300 ft section exposed from here to the top of the Llano escarpment is correlated by Machette (1978c) with the Sierra Ladrones Formation. Kelley (1977) includes most of the exposed section from here to Bernardo (mile 49.3) in his undivided middle red member of the Santa Fe Formation. However, he separates out the surficial zone of soil-carbonate (caliche) accumulation and a thin layer of gravelly to sandy sediments that he interprets as being associated with an Ortiz pediment surface that truncates the upper Santa Fe sequence. **2.2**

30.7 Milepost 193. Water tank and Belen sanitary landfill on right. Titus (1963, p. 28-29) has described a 200 ft section of the upper Santa Fe beds that crop out in the escarpment badlands area at 3:00. The section is mainly sand and gravelly sand (including sandstone and conglomeratic sandstone lenses) with several prominent zones of interbedded clay, silt, and fine sand. Units are in upward-fining (channel sand and gravel to overbank silt-clay) sequences. A strong horizon of soil-carbonate accumulation engulfs the upper sedimentation unit. No angular unconformities are noted in the section. Preliminary studies of gravel character and sedimentary structures indicate that these units may have been deposited on the distal part of a broad piedmont alluvial plain sloping gently eastward toward the aggrading fluvial plain of the ancestral river. The log of a Belen city water well drilled near this base of the described section indicates that, for at least 500 ft, the gross lithologic character of the basin fill is similar to that of the bluff outcrop (Titus, 1963, tables 1 and 2). Well-sample studies are needed to determine whether axial river deposits are present in the subsurface section. **0.8**

31.5 Exit 191, Belen interchange. **1.8**

33.3 Underpass. South Belen interchange; exit 190. Los Pinos Mountains at 11:00; Abo Pass at 10:00. About 7 mi east of this point on the Llano de Manzano is the Grober I Fugua oil test, drilled between 1937 and 1946. This 6,300 ft hole penetrated 4,550 ft of Santa Fe Group over older fill tentatively correlated with the Baca Formation. An earlier interpretation of data from this hole (Reiche, 1949) indicated that it penetrated Cretaceous and Triassic rocks below the Santa Fe section. **2.4**

35.7 Spur of Sierra Ladrones-Santa Fe Formation extending out from escarpment on left. **2.8**

38.5 Milepost 185. Crossing small floodplain embayment. About 330 ft of weakly to moderately indurated, pebbly sand to clay beds of the Sierra Ladrones-Santa Fe Formation are well exposed in high bluffs on right. **1.0**

39.5 Entering Socorro County. Milepost 184. The route ahead enters San Acacia 15-minute quadrangle, first mapped by Denny (1940, 1941). The southwestern part of the quadrangle is the site of recent studies by Machette (1978b). **1.0**

40.5 Milepost 183. Vineyards to the right. Winery ahead. **1.2**

41.7 Low roadcuts for the next 0.6 mi are in sandy fluvial facies of the Sierra Ladrones Formation (Machette, 1978b, c). **0.8**

42.5 Milepost 181. Abo Pass at 9:00 between Manzano and Los Pinos Mountains. **0.5**

43.0 Approximately three-quarters mile west of this point the Llano de Albuquerque surface (with pedogenic caliche cap) is offset at least 50 ft along a northwest-trending fault scarp. Underlying Sierra Ladrones beds are upthrown to the east; however, the amount of displacement of upper Santa Fe strata has not been determined. This high-angle normal fault was first mapped by Denny (1941, fig. 9) and is also shown on maps by Kelley (1977) and Machette (1978c). **0.5**

43.5 Milepost 180. In 1939 an oil test, Central New Mexico 1 Livingstone, was drilled 1.7 mi west of this point into the Llano surface at elevation 5,074 ft. The 2,978 ft hole penetrated an estimated 2,100 ft of Santa Fe basin fill and bottomed in possibly Cretaceous rocks. **2.0**

45.5 Milepost 179. Near this point the highway crosses the buried trace of the fault described at mile 43.0. **1.0**

46.5 Milepost 178. Roadcuts ahead are in light-gray to brown sand and sandstone with lenses of pebbly gravel and thin layers of reddish-brown clay to loam. The deposits are interpreted herein as fluvial tongues in the Sierra Ladrones Formation. **2.8**

49.3 Bernardo exit 175. Ladron Mountains at 2:00; Lemitar Mountains at 12:00; Socorro Mountains at 11:00; Magdalena Mountains on the skyline. **0.8**

50.1 Crossing Rio Puerco (Muddy River), the longest tributary entering the Rio Grande in New Mexico. This innocent-looking river contributes a great deal of sediment to Bernardo-San Acacia reach of Rio Grande valley and has a history of major floods. **2.2**

52.3 Milepost 172. The town of La Joya is on east side of river at 10:00-10:30. Bluffs above town are capped with thin alluvial-fan and terrace gravels of Arroyo de los Alamos and Salas Arroyo (lower Palo Duro Canyon). These surface gravels rest on sandy fluvial beds here interpreted as an older river channel deposit inset against Sierra Ladrones Formation. The well-preserved fan-terrace surface is graded to a level about 130 ft above present floodplain. Denny (1941) briefly describes cut-and-fill terraces in La Joya area. The San Acacia-La Joya area is near the center of a broad, elliptical bulge forming above a sill-like magma body that apparently is inflating at a depth of about 11-12 mi (Sanford, 1983; Sanford et al., 1983). **1.0**

53.3 Milepost 171. Sierra Ladrones Formation exposed in high bluffs to right. **1.1**

54.4 Overpass; exit 169. La Joya State Wildlife Refuge to left. Bluffs to right are cut mainly in distal piedmont slope to basin-floor facies of Sierra Ladrones Formation although sandy axial-river zones crop out near base of section. Machette (1978b), on basis of pebble-imbrication studies of Sierra Ladrones Formation here, interprets alluvial paleotransport directions as being from southeast to northwest in lower part of section exposed in badland area 1 mi ahead on right. A possible source are would be east of present river valley near Joyita Hills (at 10:30, just east of inner valley). The ancestral Rio Grande during this interval would thus have been west of here, probably in Loma Blanca-Sierra Ladrones belt, 5-6 mi west, where a thick section of older fluvial facies is presently exposed. **1.0**

55.4 Milepost 169. Starting ascent from Rio Grande valley to high-level surfaces bordering lower valley of Rio Salado. Cuts ahead in Sierra Ladrones piedmont facies. High ridge to right is capped with Machette's (1978a) alluvial unit G and is a remnant of 220,000 yr old terrace surface. The surface projects about 200 ft above Rio Salado and is offset about 20 ft by the Cliff fault that is exposed approximately 1 mi west of I-25 just east of abandoned part of US-85. **1.0**

56.4 Milepost 168. Crossing surface of major cut-and-fill terrace of Rio Salado, here covered with stabilized veneer of eolian sand. The terrace fill (alluvial unit E of Machette, 1978a), which was a well-preserved constructional surface 109-111 ft above Rio Salado, has an estimated age of 120,000 yrs. Denny (1941) mapped this surface as a Cañada Mariana (?) pediment, but it may be equivalent to upfaulted parts of the 98-ft cut-and-fill terrace he mapped along Rio Salado several miles upstream. **1.0**

57.4 Milepost 167. Descending into valley of rio Salado. Rest area in Holocene sand dunes on right and left. **1.1**

58.5 Crossing Rio Salado. **0.7**

59.2 Milepost 165. Route crosses low valley-border surface of latest Pleistocene age, which is formed mainly by thin fan alluvium of Rio Salado (Machette, 1978a, alluvial unit C). These deposits bury an erosion surface cut on lower piedmont facies of Sierra Ladrones Formation. Denny (1941) mapped this surface as his Cañada Mariana pediment; he designated the slightly higher graded surface west of highway as Valle de Parida (Machette, 1978a, alluvial unit D). **1.0**

60.2 Milepost 164. Crossing Rio Grande floodplain. Loma Blanca at 3:30 is a rounded hill formed by sandy fluvial beds of Sierra Ladrones Formation, the beds which Machette (1978a) interprets as Pliocene axial Rio Grande deposits. At 9:30, San Acacia constriction of Rio Grande is cut through San Acacia basaltic andesite and into basal, flat-lying basin-floor facies of Sierra Ladrones Formation (Machette, 1978a). **0.8**

61.0 Milepost 163 at San Acacia underpass. **1.0**

62.0 Milepost 162. Route ahead ascends from floodplain to low valley-border surface, here the Holocene alluvial fan of San Lorenzo Arroyo. Reddish-brown hills at 3:00 are Cerritos de las Minas. They are formed on 26-m.y.-old basaltic andesite correlated with La Jara Peak andesite (Machette, 1978b). **1.0**

63.0 Milepost 161. Crossing San Lorenzo Arroyo. Light-reddish-brown hills at north end of Lemitar Mountains (1:30-2:30) are formed on Popotosa fanglomerates. Lower hills in foreground are dissected piedmont facies of the Sierra Ladrones Formation (upper Santa Fe) with thin caps of alluvial-terrace and alluvial-fan deposits. **1.0**

64.0 Milepost 160. The east slope of the Lemitar Mountains at 2:00 includes Precambrian granites, Paleozoic sediments, and Tertiary volcanics. **3.8**

67.8 Lemitar exit 156. Overpass. **1.6**

69.4 Lemitar arroyo. Bluffs ahead in Santa Fe Formation. Loma de las Cañas at 10:00. **2.2**

71.6 Escondida (Hidden) exit 152. **0.4**

72.0 Socorro city limit. **1.4**

73.4 North Socorro, exit 150. End of roadlog.

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Mineral-collecting guide to

Wind Mountain, Cornudas Mountains,

Otero County, New Mexico

Virginia T. McLemore

With round-trip road log from US-180 (Hueco Ranch turnoff)

Total mileage: 86.6

This route begins at the turnoff to Hueco Ranch on US-180, west of the U.S. Border Patrol checkpoint. This point can be reached by traveling east from El Paso on US-180 or from southeastern New Mexico via US-180 west (see Fig. 1). The route can be completed by two-wheel-drive vehicles during dry weather conditions. The roads (Fig. 2) are maintained by the county. "Where to look" is usually given in clock-face terminology: 12:00 is straight ahead, 9:00 is due left, and 3:00 is due right. Estimated one-way travel time is 60-90 minutes.

The Cornudas Mountains are known for a variety of minerals, typically as microminerals lining vugs in the alkalic igneous rocks in the area. A list of the predominant lithology by mountain is in Table 1, and a list of minerals is in Table 2. In addition two abstracts by R. C. Boggs from the 5th and 7th New Mexico Mineral Symposia are included.

Suggested Maps

Name	Scale	Available from	Cost
Cornudas Mountain	1:24,000	NMBM&MR	$4.25
McVeigh Hills	1:24,000	NMBM&MR	$4.25
Crow Flats	1:100,000	NMBM&MR	$4.25

Mileage	
0.0	Begin the road log at the Hueco Ranch turn off at US 180. The turn off is about 0.1 miles west of the U.S. Border Patrol check point. Head north on the dirt road.
0.3	Pass through valley fill with Permian Victorio Peak limestone in the hills. 0.3
0.5	Crest of hill, notice that the limestone dips to the west. 0.2
1.1	Crest of limestone hill at "Pass with care" sign. 0.6
1.5	Campagrande formation is visible at 10:30, Cerro Alto at 11:00, and Cornudas Mountains at 2:00. The intrusions visible here and later in the log are part of a series of alkali-calcic and alkali magmas emplaced in the Diablo Plateau during the last remanent of Laramide compression between 48-32 Ma. 0.4
2.0	Continue on the pediment surface. 0.5
2.3	Water tank on left. 0.3
5.0	Road cuts in valley fill. 2.7
5.5	"Dip" sign. 0.5
5.7	The dip in the arroyo. 0.1
6.8	Road curves to the northeast with Cerro Alto at 9:00. Cerro Alto is a syenite and is dated at 34.3 $\pm$ 2.2 Ma. Table 1 lists the ages and compositions of the stocks in this area of the Trans-Pecos area. 1.1
7.2	Yellow Hueco Ranch sign, stay to the right. 0.4
7.8	Notice the east-to-northeast-dipping limestone beds at 10:00. 0.6
10.5	Sixteen Mountains Hueco limestone hills at 9:00. 3.3
10.7	You can see Cornudas Mountain, Flat Top, Wind Mountain, and Chatfield Mountain at 12:30. At 1:00 are Guadalupe Peak, El Capitan, and the western scarp of the Guadalupe Mountains. 0.2
11.3	Cerro Diablo is visible at 2:00. 0.6
11.5	Pass through basin fill and see the southern part of the Sacramento Mountains at 11:00. 0.2
11.8	Notice the anticline in the limestone hills at 10:00. 0.3
12.5	Texas-New Mexico State Line. Cattle guard with bump. 0.8
14.1	Power line crosses the road. 1.6

14.5 Pass "Hat Ranch Incorporated, The Lee's sign" and continue straight ahead. 0.4

14.8 Cattle guard with bump, road curves to the east. 0.3

15.1 Cattle guard with corral. 0.3

15.2 Cattle guard. 0.1

16.0 Cattle guard, a microwave tower at 12:00. 0.8

17.8 Pass-by the microwave tower on your left. 1.8

18.2 The Sacramento Mountains are at 10:00-12:00, Cornudas Mountains at 1:00-2:00, and Cerro diablo at 2:30-3:00. 0.4

22.4 Cattle guard. 4.2

25.3 Turn right at the "Bennett Ranch HQTRS" sign and head east-southeast toward the Bennett Ranch. 2.9

27.6 Power line crosses over the road. 2.3

28.4 Bear left around the corrals and stay outside of the fences. Road curves to the northeast toward Alamo Mountain. 0.8

28.6 Cerro Diablo at 1:00. 0.2

31.5 Turn right and drive through the cattle guard to the east toward Alamo Mountain. 2.9

31.6 Bear right on south side of the fence and head southeast parallel to the fence line. 0.1

32.9 Descend into the arroyo. 1.3

33.0 Cross over the arroyo. 0.1

34.4 Toward the east is Chatfield Mountain. Follow the fence line that is the Texas-New Mexico State Line. 1.4

34.8 Cattle guard. 0.4

35.0 As you crest this hill, you will see Flat Top at 10:00, Deer Mountain at 10:30, Wind Mountain at 11:00, Chatfield Mountain behind San Antonio Mountain at 12:00, Washburn at 12:30, and Cerro Diablo at 1:00 (Fig. 3). 0.2

37.0 Bear left up the draw toward the north. 2.0

37.2 Cross the draw. 0.2

37.7 Drive out of the draw and bear right. 0.5

38.0 Head east toward the saddle between Wind and San Antonio Mountains. 0.3

38.4 Turn left toward Flat Top Mountain. 0.4

38.6 Turn east. 0.2

39.3 Pass through the gate but leave it as you found it. 0.7

40.3 Bear to the left toward the draw between Deer and Wind Mountains. 1.0

41.0 Deer Mountain is on the left at 10:00. Notice the columnar jointing at the tops of San Antonio, Deer, and Flat Top Mountains. 0.7

41.9 Bear right toward Wind Mountain well. 0.9

42.0 Pass by abandoned ranch house on your left, do not go through the corral. Stay on the poorly defined road at the corral that starts at the southernmost fence post. Stay south of the corral fence. 0.1

42.1 Head south with Wind Mountain on your left. The road will wind around a bit, but will head generally south. 0.1

43.1 Turn left toward the Addwest Minerals pits visible part way up Wind Mountain. 1.1

43.3 End of road log. Retrace route back to US 180. 0.2

The road log ends at the Addwest Minerals Inc. pits. Addwest Minerals, Inc. plans to quarry nepheline syenite for potential use in ceramics and dark-colored glass beverage containers, as abrasives, as dimension stone, as roofing granules, and as fillers. The minerals listed in Table 2 are found as microminerals in vugs and interstitial to other minerals the igneous rocks. Other areas throughout the Cornudas Mountains are favorable sites. Be careful, be courteous, clean up, and have fun!

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Table 1-Igneous intrusive bodies in the Cornudas Mountains. Locations are in Fig. 3

Name	Predominant lithology	Form	Age	References
Alamo Mountain	phonolite, foliated porphyritic nepheline syenite	discordant sheet or sill	36.8 ± 0.6 (K/Ar on biotite)	Barker et al. (1977); Clabaugh (1941); Henry et al. (1986)
Flat Top Mountain	phonolite, augite syenite dike	sill		Barker et al. (1977); Clabaugh (1941)
Cornudas Mountain	quartz-bearing syenite, syenite, trachyte	plug or laccolith	34.6 ± 1.5 (K/Ar on biotite)	Barker et al. (1977); Zapp (1941); Henry et al. (1986
Wind Mountain	nepheline syenite, phonolite, porphyritic nepheline syenite	laccolith		Barker et al. (1977); Warner et al. (1959); McLemore and Guilinger (1993)
San Antonio Mountain	nepheline syenite	laccolith		Timm (1941); Barker et al. (1977)
Deer Mountain (Little Wind Mountain)	nepheline syenite	plug or laccolith	33.0 ± 1.4 (K/Ar on biotite)	Barker et al. (1977); Clabaugh (1941, 1950); Henry et al. (1986)
Chatfield Mountain	phonolite	sill		Timm (1941); Barker et al. (1977)
Black Mountain	porphyritic nepheline syenite	sill		Barker et al. (1977)
Washburn Mountain	porphyritic nepheline syenite	sill		Barker et al. (1977
Unnamed hill	nepheline-bearing augite syenite	plug	36.8 ± 0.6 (K/Ar on biotite)	Barker et al. (1977); Clabaugh (1941); Henry et al. (1986)

Table 2-Selected less-common minerals reported from the Cornudas Mountains.

Mineral	Chemical formula	Occurrence	Reference
analcime	$NaAlSi_2O_6 \cdot H_2O$	replaces nepheline, lines vugs, vesicles and miarolitic cavities	Barker and Hodges (1977); Boggs (1985)
natrolite	$Na_2Al_2Si_3O_{10} \cdot 2H_2O$	replaces nepheline and feldspars	Barker and Hodges (1977)
olivine	$(Mg,Fe)_2SiO_4$	mineral aggregates of ferromagnesium minerals and magnetite	Barker and Hodges (1977)
aenigmatite	$Na_2Fe_5{}^{+2}TiSi_6O_{20}$	in nepheline syenite	Barker and Hodges (1977)
eudialyte	$Na_4(Ca,Ce)_2(Fe^{+2},Mn^{+2}),Y$ $ZrSi_8O_{22}OH,Cl)_2$	in dikes, sills, and laccoliths and in miarolitic cavities	Barker and Hodges (1977); Clabaugh (1950); Boggs (1985, 1987)
catapleiitie	$Na_2ArSi_3O_9 \cdot 2H_2O$	miarolitic cavities	Boggs (1985)
georgechaoite	$NaKZrSi_3O_9 \cdot 2H_2O$	miarolitic cavities	Boggs (1985); Boggs and Ghose (1985)
aegirine (acmite)	$NaFe^{+3}Si_2O_6$	miarolitic cavities	Boggs (1985, 1987)
monazite	$(Ce,La,Th,Nd)PO_4$	miarolitic cavities	Boggs (1985)
thomsonite	$NaCa_2Al_5Si_2O_{20} \cdot 6H_2O$	miarolitic cavities	Zapp (1941); Boggs (1985)
chabazite	$Ca(Al_2Si_4O_{12}) \cdot 6H_2O$	miarolitic cavities	Boggs (1985)
parakeldyshite	$Na_2ZrSi_2O_7$	nepheline syenite, Wind Mountain	McLemore and Guilinger (1993)

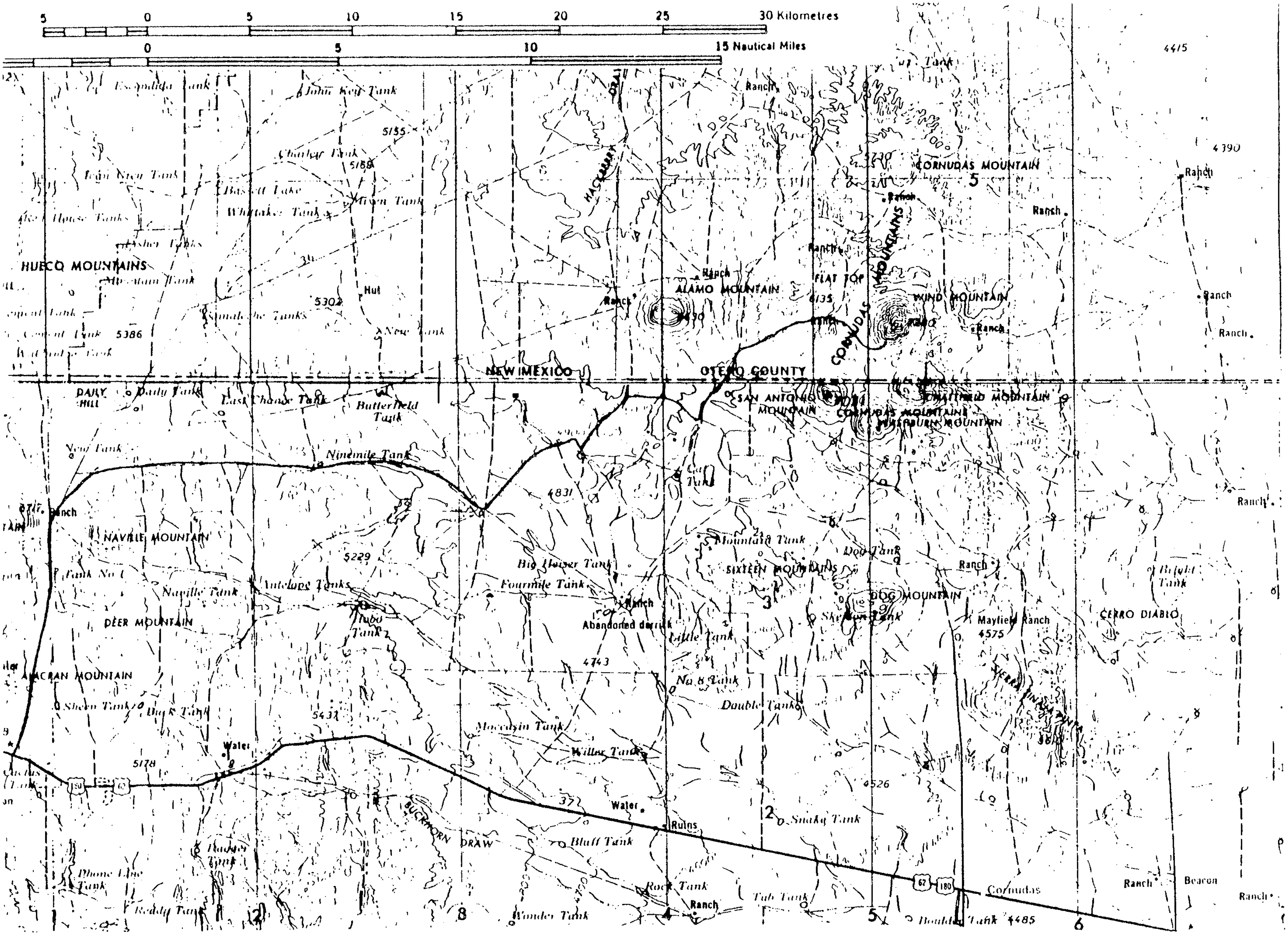

FIGURE 1 - Location of Cornudas Mountains.

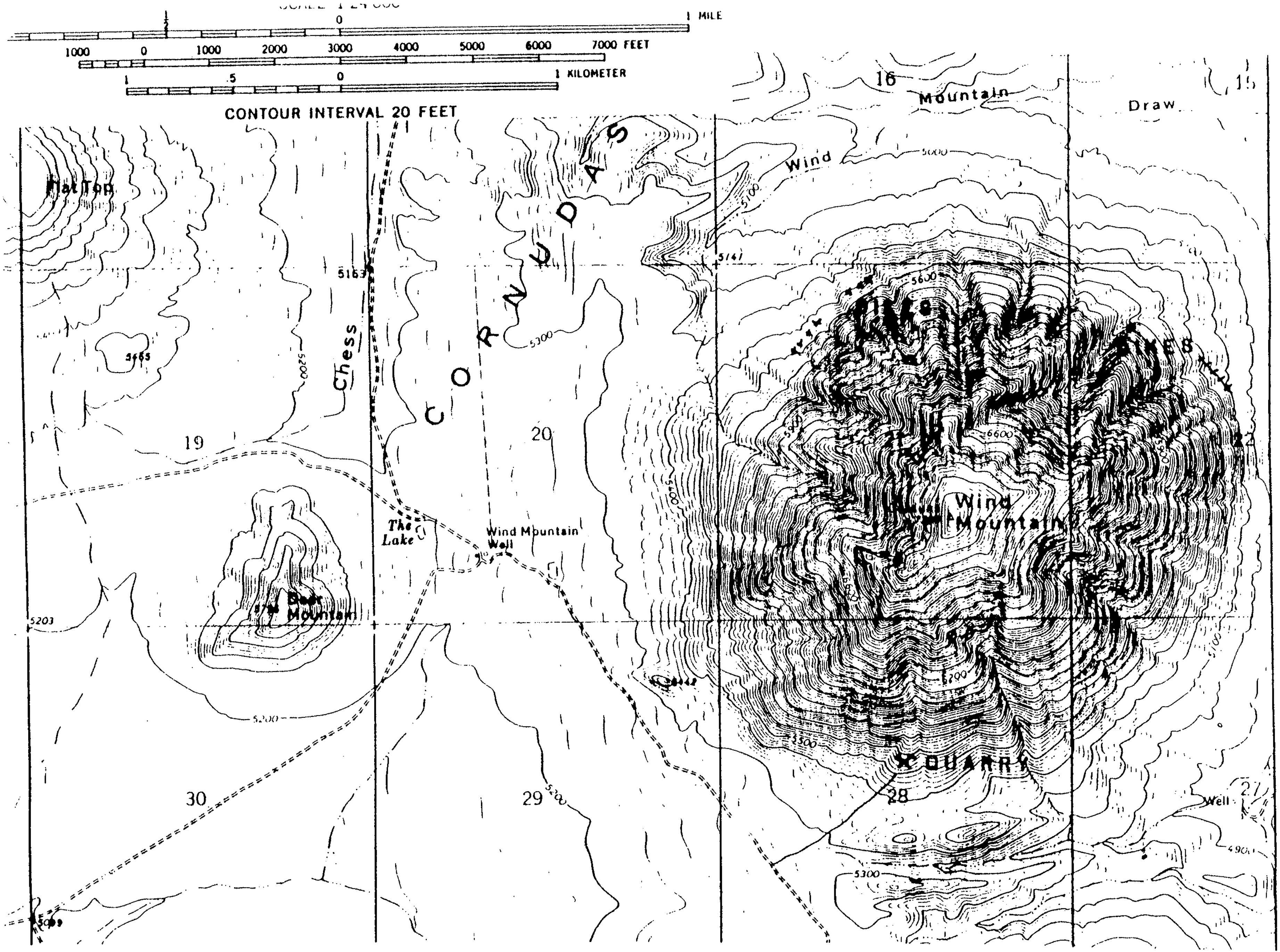

FIGURE 2 – Location of Wind Mountain quarry.

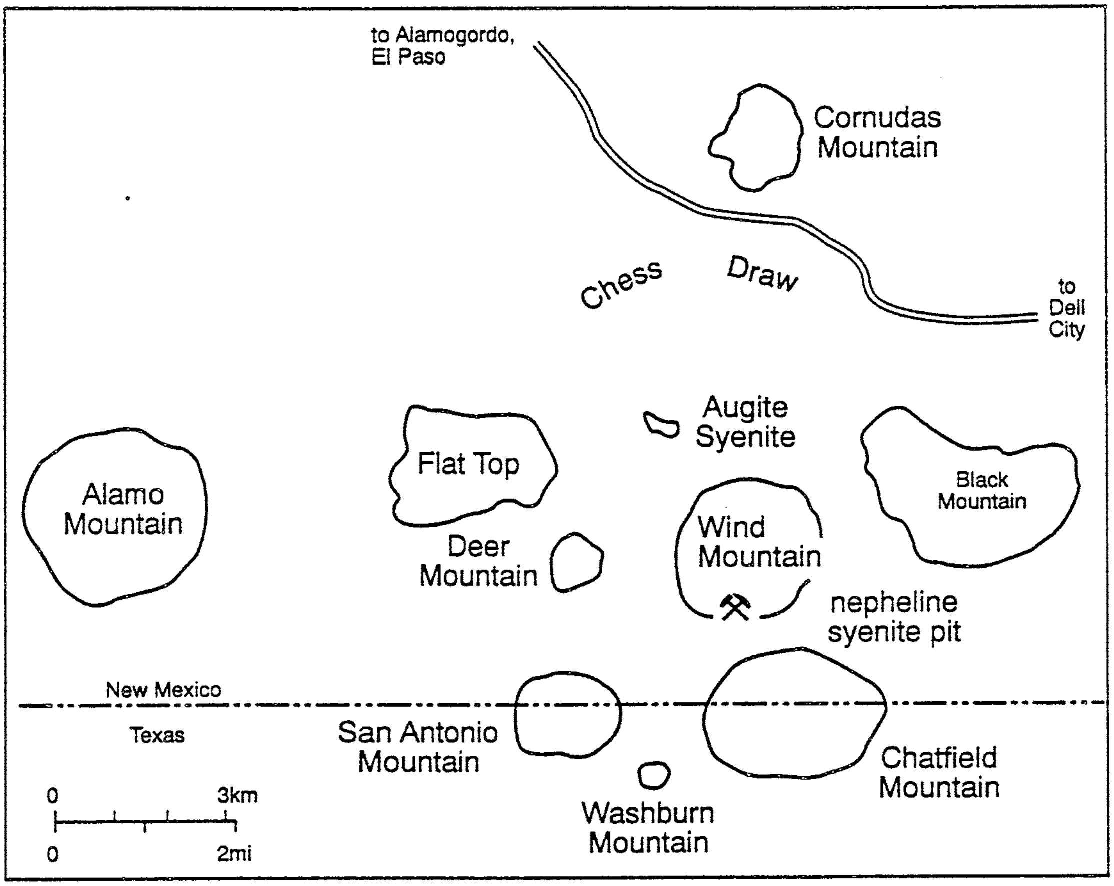

Figure 3 - Map of Cornudas Mountains

MINERALOGY OF THE WIND MOUNTAIN LACCOLITH
OTERO COUNTY, NEW MEXICO

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The Eocene Wind Mountain laccolith crops out over approximately 2 km^2 in southern Otero County, New Mexico. It is one of several small intrusions that were emplaced as discordant sheets, sills, and laccoliths into Permian and Cretaceous sediments of the Cornudas Mountains Area. It consists of an analcime nepheline syenite. Miarolitic cavities in the laccolith contain a suite of uncommon minerals that is similar to the suite found at Mont St.-Hilaire, Quebec, Canada. Most notable is georgechaoite, $NaKZrSi_3O_9 \cdot 3H_2O$, a new mineral related to gaidonnayite, $Na_2ZrSi_3O_9 \cdot 3H_2O$. Georgechaoite occurs as white, twinned, ortho-rhombic crystals up to 1 mm in size. It is associated with microcline, acmite, nepheline, analcime, catapleiite, monazite, and Mn-rich chlorite. Other minerals not found directly associated with georgechaoite include chabazite, eudialyte, calcite, thomsonite, and natrolite. It is likely that many other minerals will be found by collectors at Wind Mountain, as well as at some of the other intrusions in the Cornudas Mountains area.

The miarolitic cavities range in size from approximately 1 cm to 3 cm in diameter. The crystals in the cavities are usually small, seldom exceeding 5 mm (for minerals such as microcline, nepheline, and acmite) and commonly only 1 mm to 2 mm for the rarer minerals. The sequence of formation of the minerals in the cavities is as follows (earliest to latest): microcline, nepheline, analcime, acmite, chlorite, catapleiite, monazite, and georgechaoite. A brief description of some of the species follows.

Analcime has formed in part from the alteration of nepheline and is commonly found as coatings of euhedral crystals replacing nepheline crystals.

Catapleiite is found as small (<1 mm), euhedral, orange to white, hexagonal, tabular crystals. They commonly form rosette-like groups and are perched on microcline or acmite.

Georgechaoite occurs as small (≤ 1 mm), white, twinned, prismatic crystals. They are commonly found growing on either microcline or acmite.

Monazite occurs as small (≤ 1 mm), yellow, prismatic crystals that are commonly perched on acmite.

Nepheline occurs as hexagonal prisms commonly altered, in par, to analcime.

Thomsonite is found as radiating balls of transparent prismatic crystals.

MINERALOGY AND TEXTURES OF A EUDIALYTE-BEARING DIKE
WIND MOUNTAIN, OTERO COUNTY, NEW MEXICO

(Location 6 on index map)

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A eudialyte-bearing dike approximately 1 m thick by 100 m long has intruded the surrounding county rock near the western edge of the Wind Mountain laccolith. The dike consists predominantly of albite, potassium feldspar, nepheline, and acmite. The main accessory mineral is eudialyte. The eudialyte makes up about 5% of the rock although it is irregularly distributed in the dike and locally makes up 20% of the rock. The dike shows interesting textures with margins consisting of large crystals of acmite up to 4 cm long arranged perpendicular to the walls. The spaces between these crystals and the center of the dike consist of smaller
1-2 mm) crystals of feldspars, nepheline, acmite, and eudialyte. Quartz is found locally very near the margins of the dike and has presumably formed by assimilation of silica from the country rock, which is a marly shale to impure silty limestone. Eudialyte is concentrated toward the center of the dike. In thin section many of the eudialyte crystals show color zoning with a pink to brown pleochroic rim and colorless core.

Compositionally the acmites are close to pure $NaAlSi_2O_6$ with minor amounts of CaO, Al_2O_3, ZrO_2, and TiO_2 the main other oxides present. CaO ranges from 0.7 to 4.6 wt %. The larger crystals near the margin of the dike show Ca-rich cores (up to 1.7 wt. % CaO) and Ca-poor rims (0.7 to 0.8 wt. % CaO). The cores of smaller crystals appear to be richer in Ca with some as high as 4.6 wt. % CaO. The acmites also show uncommonly high contents of ZrO_2 of from 0.8 to 3.4 wt. %. The eudialytes tend to be quite uniform in composition with little core to rim variation. Apparently the variation that accounts for the color zoning is an increase in MnO (from 3-4 wt. % in the core to 5 wt. % at the rim) and a corresponding decrease in FeO (from 3.5-4 wt. % in the core to 2.7-3 wt. % at the rim). A typical analysis of the eudialyte yields the following results expressed as percentages: SiO_2, 47.07; ZrO_2, 13.39; TiO_2, 0.18; Al_2O_3, 0.01; La_2O_3, 1.22; Ce_2O_3, 2.05; Pr_2O_3, 0.30; Nd_2O_3, 0.37; Sm_2O_3, 0.05; Eu_2O_3, 0.74; Gd_2O_3, 0.46; CaO, 3.69; FeO, 2.71; MnO, 5.12; MgO, 0.21; Na_2O, 13.22; K_2O, 0.40; F, 0.59; Cl, 2.71 (estimated); total 92.16. The albites range from Ab_{96} to Ab_{99} and the potassium feldspars range from Or_{64} to Or_{94}. Both feldspars contain less than 0.5% of the anorthite end member. The nephelines show considerable silica in solid solution and approach the maximum silica content that can occur in nepheline ($Ne_{85}Qz_{15}$).

The dike can be traced into the main body of the Wind Mountain laccolith (an analcime-nepheline syenite) where it appears to grade into a zone of poorly defined dike-like bodies. The dike is interpreted to have formed from a late-stage Zr-rich pegmatitic magma that was injected into the surrounding country rock from the laccolith, possibly along a fracture formed during the doming of the overlying sediments. The dike began to crystallize under water-rich conditions that lead to the formation of the large acmite crystals. Before crystallization was complete, however, the system lost water pressure (presumably by further fracturing and venting to the surface), and the remaining magma was pressure quenched, producing the fine-grained center of the dike. The quenching was due to the shallow level of emplacement of the laccolith, which has been estimated to have been less than 1 km. The center of the dike is enriched in eudialyte because of further concentration of Zr in the remaining magma during crystallization of the acmite.

MINERAL COLLECTING GUIDE TO THE MAGDALENA, N.M. AREA

Round-trip road log from Socorro to Magdalena
with stops at Water Canyon, Kelly, and the Pueblo and
Silver Hill subdistricts of the North Magdalena district.

Total mileage: 77 miles

Mineral Collecting in the Magdalena Area

The Magdalena Mining district has produced many fine specimens of smithsonite, azurite, barite, calcite, sphalerite, fluorite, malachite, rosasite, aurichalcite and other species. As always, the best specimens were found during active mining but interesting material is still found on the dumps. Arrangements for collecting on the dumps of the Graphic and Nitt mines should be made <u>in advance</u> through Bill Dobson of Magdalena; call 854-2236 or inquire at Bill's Gem and Mineral Shop.

This guide also gives side trips to Water Canyon and the North Magdalena mining district. Water Canyon has beautiful scenery, some small flecks of gold, and several small mines. The area has yielded few mineral specimens, but is a favorite picnic spot for Socorroans. The North Magdalena district has produced nice "micros" of several species, some of which are quite unusual.

The trip can be made easily in a two-wheel drive vehicle during the dry season.

Abstracts of papers from past symposia on the field trip areas are given at the end of the road log.

Round-trip road log from Socorro to Magdalena
with stops at Water Canyon, Kelly, and the Pueblo
and Silver Hill subdistricts of the North Magdalena district

0.00	Leroy and School of Mines Road. Turn right on Leroy. 0.15
0.15	Bear left onto Neel Street. 0.85
1.00	Town House Motel. Head west on US 60 to Magdalena. 0.4
1.40	Railroad Crossing. These tracks are used to haul perlite from the Dicaperl plant to the AT&SF Railroad. 0.4
1.80	Socorro High School is on the left. Socorro Peak is on the right. 0.6
2.40	National Guard Armory is on the left. Good Sam Nursing Home is on the right. 0.7
3.10	Road to Dicaperl perlite plant on the right. 0.2
3.30	Bridge. 1.25
4.55	Road to Old Great Lakes Carbon perlite plant. 2.35
6.90	Road on left to the northern part of the Luis Lopez Manganese district. The Luis Lopez district produced 50,630 short tons of manganese, mostly during the 1940's and 1950's (Eggleston and others, 1983). The ore deposits are veins in the Hells Mesa Tuff which contain the cryptomelane group ("psilomelane") minerals: coronadite, cryptomelane, and hollandite. 0.7
7.60	Bridge over Box Canyon. 0.6
8.20	Bridge. 0.7
8.90	Start up Sedillo Hill. 2.0
10.90	Top of Sedillo Hill. Parking area with trash barrels on right. The Magdalena Range is on the left. 2.5
13.40	Bridge. Hells Mesa (Bear Mountains) is straight ahead in the distance. 0.7
14.10	Bridge. 0.2
14.30	Water Canyon Lodge on the right. 1.4
15.70	Sign, "Litter Barrel Ahead 100 ft," is on the right. Slow and prepare to turn left on Water Canyon Road (Forest Road 235). 0.2
15.90	Turn left on to Water Canyon Road. 0.2
16.10	Junction with Forest Road 505. continue ahead on Forest Road 235. 0.8
16.90	Cattle guard. 0.4
17.30	STOP 1. Cattle Guard. Entering forest land. Park along road for gold panning. Small amounts of gold have been found in the washes on the right (west) side of the road for the next ½ mi. You will need to bring your own water, or transport the material to be panned to Water Canyon, if water is running there. Continue to Water Canyon Campground to turn around. 0.6
17.90	Entering private land. 0.25
18.15	Cattle Guard. 0.25
18.40	Entering forest land. 0.20
18.60	Pavement ends. Water Canyon Campground. Several small mines that are described by Lasky (1932) are in this area. Langmuir Laboratory is ahead 10 mi on Forest Road 235. Retrace route to US 60. 4.65
23.25	Junction of Forest Road 235 and US 60. Turn left (west) on US 60 toward Magdalena. 2.05
25.30	Bridge. The remains of bridge along the grade of the Magdalena branch of the AT&SF

can be seen on the right. This line was completed in 1883 to haul ore from the Magdalena district (chiefly the Kelly and Graphic mines) to the Billing smelter in Socorro. The branch was abandoned in the early 1970's. 0.7

26.00 Bridge. Railroad grade on right. The rugged mountain range in the distance on the right is the Ladron Mountains ("Outlaw Mountains"). 1.0

27.00 Forest Road 505 is on the left. Ladron Mountains are on the right. 3.95

30.95 Road on the right leads to Hudgins Ranch. 1.2

32.15 Road on the left leads to Anchor Canyon Mill. This mill processed barite from the North Magdalena district. 1.6

33.75 Magdalena Village limit. 0.05

33.80 Stella's Rock and Bottle Shop is on the left. Magdalena Post Office is on the right. 0.2

34.00 Magdalena Ranger Station is on the left. Turn left on the road next to the Ranger Station. 1.1

35.10 Pavement ends. 0.75

35.85 Cattle guard. 0.15

36.00 Road forks. Bear left. Remains of ASARCO

36.55 Road to Graphic-Waldo mine is on the left. This mine is currently under lease to the NM Tech Mining Department. 0.8

37.35 Kelly Gulch. SLOW! 0.15

37.50 STOP 2. Kelly Church. Kelly was once a thriving town of 3,000 people. The first ore discoveries were made in the late 1860's. The earliest activity was mining for silver, lead, and copper; mining for zinc followed later. Fine mineral specimens of smithsonite, azurite, cerussite, calcite, rosasite, malachite, barite, pyrite, sphalerite, fluorite, and aurichalcite have been produced from the district. The ore deposits of the district are contact metasomatic and replacement deposits found predominantly in the Kelly Limestone. A complete discussion of the geology and history of the district is given by Loughlin and Koschmann (1942). Retrace route to US 60. 3.4

40.90 Highway 60. Turn left. Bill's Rock Shop is on the left. Bill Dobson owns the dumps of the Nitt and Graphic mines and will allow mineral collecting for a small fee ($2.00 in 1984). Make arrangements by calling bill at 505/854-2236 or by inquiring at the shop. 0.3

41.20 Turn right past Evett's store. 0.05

41.25 Old Magdalena station on right. The station has been refurbished and is used as the Magdalena Library and City Hall. Prepare to turn right on Forest Road 354.

41.25+ Turn right on Forest Road 354. 0.25

41.50 Cattle guard. Granite Mountain is straight ahead. 0.1

41.60 Road forks. Bear left on Forest Road 354. Right fork goes to Magdalena airstrip. 0.2

41.80 Road forks. Bear left on Forest Road 354. Right fork goes to Magdalena cemetery. 0.25

42.05 Cattle guard. 0.75

42.80 Turn left on road that leads to prospects in the Pueblo subdistrict of the North Magdalena district. This district has been a small producer of silver, lead, vanadium and barite. 0.1

43.00 Turn left on VERY DIM road. 0.1

43.10 STOP 3. Park at top of hill. Small shaft to left. This is on the Old Bell claim, relocated in 1982 as the "Silver Glance". This prospect has produced nice small crystals of vanadinite associated with galena, barite, and descloizite. Retrace route to US Highway 60. 2.0

45.10 Turn right on Highway 60. 0.4

45.50 Bridge. Prepare to turn right on NM 52. 0.1

45.60 Turn right on NM 52 (Forest Road 128). 0.45

46.10 Cattle guard. Turn left just after cattle guard on Forest Road 10. 1.35

47.45 Turn right on road up draw. 0.05

47.50 Stock tank is on the left. Silver Hill is straight ahead. 0.1

47.60 STOP 4. Park in flat area past tank. Prospects on left. The Silver Hill area has produced small amounts of copper and silver (North, 1983). Some rare species from this district were described at the 1982 Mineral Symposium. They include conichalcite, duftite, and fornacite. (See abstracts at end of road log.) Retrace route to NM 52. 1.4

49.00 NM Highway 52. Turn right. 1.5

50.50 US Highway 60. Retrace route to Socorro. 26.0

76.50 Socorro.

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VANADINITE AND RELATED LEAD-ZINC MINERALS, NORTH MAGDALENA DISTRICT SOCORRO COUNTY, New Mexico

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The consumption of vanadium and vanadium-steel in the United States has been gradually increasing since the early 1960's, according to figures given by the U.S. Bureau of Mines. New Mexico is in the top five producing states along with Idaho, Colorado, Utah, and Arizona. In New Mexico vanadium minerals have been reported in at least 14 mining districts, but production has come from only four: the Lucky Bill mine, Central district, Grant County; the Caballo Mountains district, Sierra County; the Hall mine, Hillsboro district, Sierra County; and the North Magdalena district, Socorro County. It is this last one with which this report deals.

The North Magdalena mining district lies generally north to northwest of the town of Magdalena. The center of the district can be reached by going approximately 2.8 mi north from town on Forest Road 354 (road to Riley). The district includes the eight claims of the Jack Frost group, four claims of the Night Hawk group, and the two claims each of the Pleasant View group, and the Pennsylvania group, giving a total of 16 claims. In these 16 claims are located well over 100 pits, shafts, tunnels, prospect holes, and the like. Present ownership of the claims is vague. The author, upon checking the county claim files, discovered that no one has claimed either the Jack Frost or the Night Hawk groups since 1969, but did discover that a Henry L. Papa has claimed the Hawk mining group in all of the preceding ten years except 1971 and 1975. In all probability, this Hawk mining group is synonymous with the Night Hawk group. Also, no owner has been listed since 1969 for the Pleasant View or Pennsylvania groups, unless they have been incorporated into the Hawk (Night Hawk) mining group.

A small but productive history of the mining district is known. According to various reports, shipments were made by ox teams from these claims in the early days of the district to the smelters at park City and to the old Pennsylvania smelter at Pueblo Canyon. Between 1925 and 1929 N. L. Brown of Albuquerque marketed vanadium concentrates from the Jack Frost/Night Hawk claims; minor amounts of vanadium, lead, zinc, copper, silver and gold were shipped to the stamp mill at Pueblo canyon from the Pleasant View and Pennsylvania claim groups. In all, no more than 150 tons of vanadium ore and 50 tons of lead/zinc were smelted. It is interesting to note that the Pleasant view and Pennsylvania claims were originally opened as gold and silver prospects.

Nearly all the veins in the area have long surface or near-surface outcrops and are of the shear-zone/fault-contact type. The ores occur in small pockety shoots and fill fissure and breccia openings. The predominant rocks of the area are andesite and a quartz latite. Basic dikes are numerous and in many places form vein walls. White rhyolite is present in some places, suggesting a flow structure. The working and prospecting of the claims varies widely. In general, the veins have been prospected by numerous shafts, cuts, and pits. The Jack Frost claim consists of a shaft 140 ft deep, with drifts 105 ft long on four levels. Because of bad timbering, though, the shaft is inaccessible below 30 ft. The headframe, hoist house, and steam power/concentrating plant remain at the mine site. At the Pleasant View claims a well timbered shaft has been sunk to a depth of 90 ft. Water was reportedly struck at 60 ft and, for the most part, makes the mine inaccessible. The Pennsylvania group consists of numerous pits, shafts, and tunnels.

Generally speaking, crystals of lead-, zinc-, and copper-vanadates are common in the oxidized zones of the deposits. These crystals, in the form of vanadinite, descloizite, mottramite, and cuprodescloizite along with angelsite and galena, are irregularly scattered in the oxidized zones. Where they are concentrated in "veins" or patches, called "vugs", some material of "commercial" grade can be obtained by selective mining. Other minerals present in the district include the copper-silver suite, chalcocite, covellite, and argentite, and some SMALL MINOR amounts of gold and silver. In some veins the type of mineralization exposed seems to bear a decided relationship to the kind of wall rock or breccia in the vein. Gangue minerals include a fairly good amount of white to pale-red barite, calcite and/or aragonite, cerussite, chalcopyrite stains, quartz, and locally abundant fluorite.

Vanadinite, ($Pb_5(VO_4)_3Cl$) occurs as small, orange to red, hexagonal crystals 1-4 mm in width and reaching 5-7 mm in length. Descloizite ($PbZn(VO_4)(OH)$) occurs as small, green to brown to black microcrystals with and sometimes on the vanadinite. The other minerals, galena (PbS), covellite (CuS), Chalcopyrite ($CuFeS_2$), anglesite ($PbSO_4$), argentite (Ag_2S), and chalcocite (Cu_2S) occur in small amounts in veinlets near the vanadinites. All the gangue minerals except fluorite occur abundantly throughout the ores. It is quite possible to collect specimens which contain crystals of many, if not all, the above minerals.

On a recent trip the following notes were taken: activity in the form of trenching was underway at the Night Hawk claims; the main pit for vanadinite crystals had been carelessly destroyed by foolish rockhounds using explosives; the Jack Frost mine is as unstable as it has ever been; and mucking through the existing dumps can prove rewarding. From experience vanadinite of a yellower color has been found deep within the Jack Frost and Pleasant View mines.

With a little patience and determination, and a lot of luck, quality vanadinite can be collected here in the North Magdalena district.

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MINERALS OF THE SILVER HILL SUBDISTRICT
SOCORRO COUNTY, NEW MEXICO

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The Silver Hill subdistrict is located in the western half of the North Magdalena mining district about 2 mi northwest of Magdalena, New Mexico. The district has produced a small amount of copper and silver from fissure veins in basaltic andesite.

Recently, small crystals resembling fornacite $(Pb,Cu)_3$ $[(Cr,As)O_4](OH)$ were found on the Bullfrog #2 claim about ½ mi southwest of Silver Hill. SEM and microprobe analyses show that the material contains Pb and Cu in the +2 valence site and Mo and minor As, V, and Cr in the +5 and +6 valence sites in the structure. X-ray diffraction shows that the mineral has the structure of fornacite. This chemistry and structure would make the material identical to a newly described, but as yet unnamed, mineral from Tsumeb. The mineral is associated with descloizite, willemite, mimetite, chrysocolla, and hematite.

Other recent finds of micro-crystals from other mines and prospects in the district include duftite, $PbCu(AsO_4)(OH)$, conichalcite, $CaCu(AsO_4)(OH)$, and apatite, $Ca_5(PO_4)_3F$. Iranite, $Pb_{10}Cu(CrO_4)_6(SiO_4)_2(F,OH)_2$, is also reported from the district but has not been confirmed.

MINERALS OF THE MAGDALENA MINING DISTRICT SOCORRO COUNTY, NEW MEXICO

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One of the most profitable mining districts in the "Land of Enchantment", both for the miner and the mineral collector, is the Magdalena district. The district is located in the Magdalena Mountains, about 26 mi west of Socorro in central New Mexico. During the 20 years from 1880 to 1900, the district produced approximately $8 million, mostly from lead ores. However, the district did produce large amounts of zinc, mostly from the mineral smithsonite, the apple-green specimens of which are known worldwide. Although the district is "potmarked" with mines and prospect pits, the three most important mines, both for ore production and for mineral specimens, are the Kelly, Juanita, and Waldo-Graphic mines.

The Kelly mine, which is located closest to the actual town of Kelly, produced the world-famous apple-green specimens of smithsonite. Although prize specimens of the green variety are rare today, small, white or gray, botryoidal masses are not uncommon. Cream to brown-colored blades of barite have been collected recently, as well as good specimens of fluorescent "dogtooth" calcite.

The Juanita mine is also near the town of Kelly and at one time was connected to the Kelly mine. Recently, this mine has produced many fine, brown, bladed clusters of barite, as well as specimens of calcite and aragonite. Some fine metallic goethite specimens and a rare mineral, barytocalcite, ($BaCa(CO_3)_2$), have been collected here.

Finally, the Waldo-Graphic mine, located approximately 1 km north of the town of Kelly, offers a wide range of mineral species. The "Pyrite Room" of the 9th level has produced many fine pyrite specimens, especially small (1 to 2 cm), cubic, crystal clusters. Between the 5th and 6th levels is a large copper oxidation zone that produced such minerals as chalcanthite, aurichalcite, tenorite, malachite, azurite, and rosasite associated with hemimorphite, smithsonite, hematite, and ilmenite. Throughout the mine there are several occurrences of prized calcite specimens, especially the masses of hexagonal plate crystals from the 9th level, misnamed, "Aragonite Room".

This is only a small list of the more common minerals found in the district; Stuart Northrop's <u>Minerals of New Mexico</u> reports more than 100 specimens from the district.

FIGURE 1. Index map of the Socorro area.

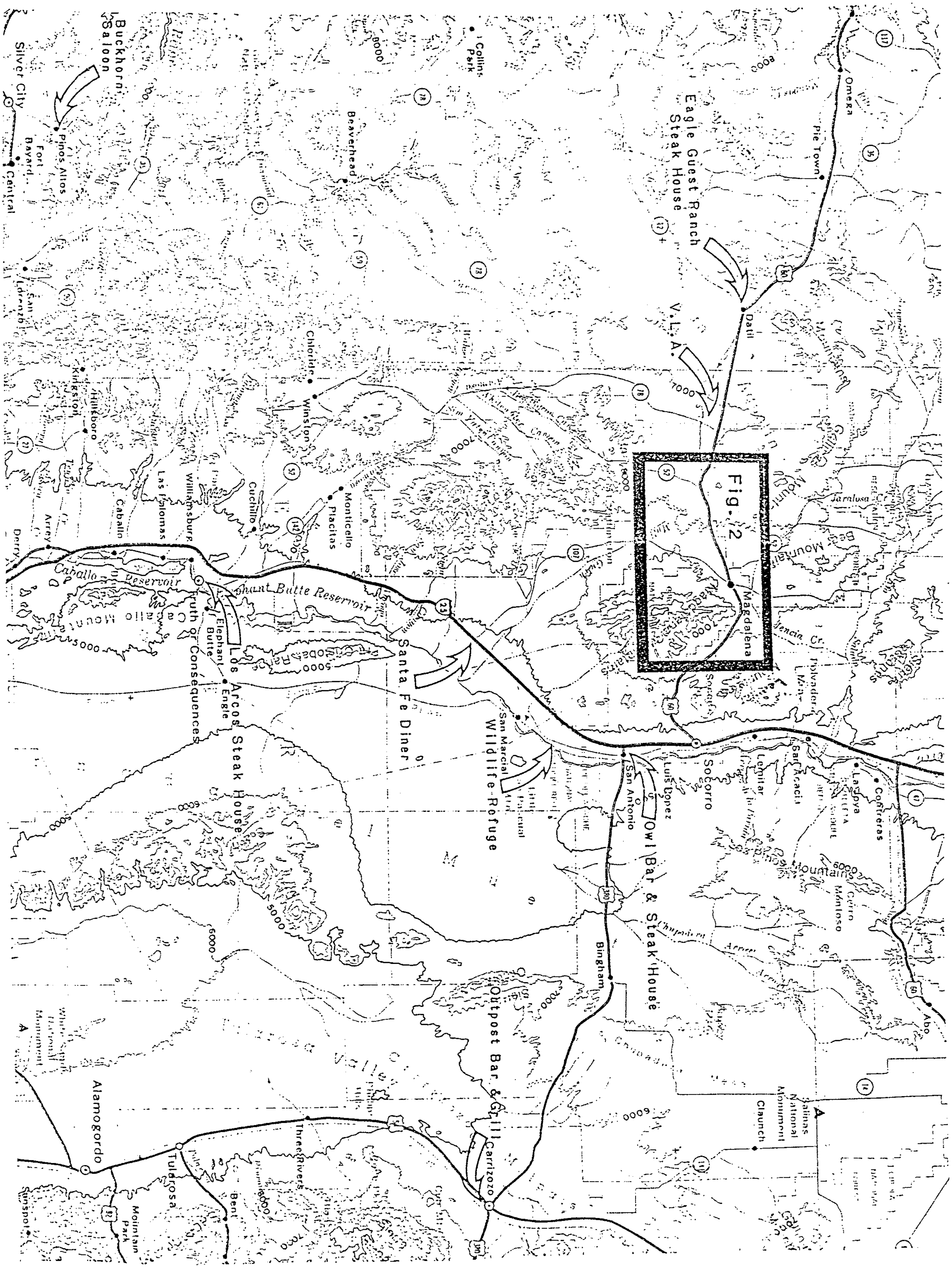
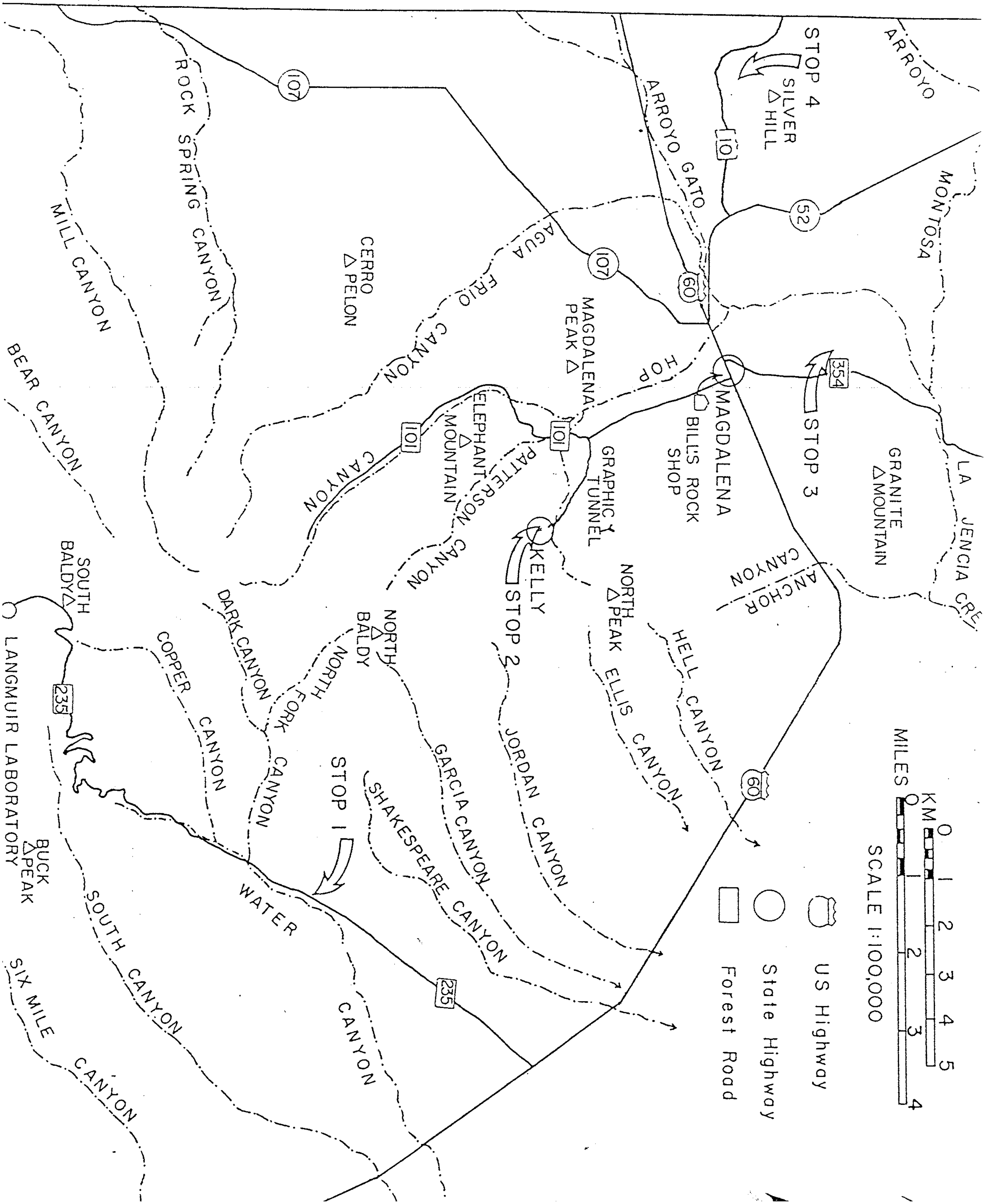


FIGURE 2. Map of the Magdalena area.



MICROMOUNT MINERAL COLLECTING IN THE BIG LUE MOUNTAINS OF EASTERN ARIZONA AND WESTERN NEW MEXICO

Ronald Gibbs

With one-way road log from the intersection of US 180 and NM 78 to collecting areas along AZ 78

Total mileage: 21.7 miles

Micromount mineral collecting in the Big Lue Mountains of eastern Arizona and western New Mexico

There are many good mineral-collecting localities for the micro-mounter in the Big Lue Mountains of eastern Arizona and western New Mexico. The area described lies between the towns of Mule Creek, New Mexico and Clifton, Arizona. In the collecting area, the mountains are primarily composed of Tertiary volcanic flows, flow breccias, and tuffs of rhyolite capped by younger Tertiary volcanic flows of basalt and basaltic andesite. The older volcanics host a suite of minerals similar to the topaz-bearing rhyolites of the Black Range of New Mexico whereas zeolites can be found in the younger basalts. Fine crystals of hematite, pseudobrookite, titanite, phlogopite, and several unidentified species can be found in vesicles lined with quartz and/or tridymite. The vesicular portions of the overlying basalts host the zeolites heulandite and offretite (erionite?) and some unidentified species as well as quartz and calcite.

The localities listed are just a few of the possible collecting areas. Exploration of stream beds and outcrops away from the road will undoubtedly yield additional localities and perhaps additional species. With the exception of the Coal Creek locality, all are roadcuts along Arizona Highway 78. All sites are accessible by automobile. Always use caution when collecting from roadside localities; the road is winding and traffic, although sparse, can come up on you in a hurry.

Suggested Equipment and Maps

4-lb crack hammer

safety glasses or some kind of eye protection

10X hand lens

Big Lue Mountains, AZ-NM 15′ USGS quadrangle map, scale 1:62,500 or

Big Lue Mountains, AZ-NM 7.5′ USGS quadrangle map, scale 1:24,000

Gila National Forest map

MICROMINERALS FROM THE BIG LUE MOUNTAINS

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The Big Lue Mountains of eastern Arizona and western New Mexico offer several good collecting opportunities for the micromounter. Good micromount specimens have been found in several localities near the state line along New Mexico and Arizona State Highway 78 west of Mule Creek, New Mexico.

The Big Lue Mountains are composed of Tertiary rhyolitic volcanics and younger Tertiary basaltic volcanics as flows and tuffs. The volcanics are often vesicular and host two distinct suites of minerals of interest to collectors. Minerals found in the older volcanics are similar to the Black Range topaz-bearing rhyolites and include:

pseudobrookite
titanite
hematite
tridymite
phlogopite
hollandite

Several unidentified minerals are present but they appear to be pseudomorphs after an undetermined mineral. Pseudobrookite is fairly common, occurring as slender elongated euhedral blades that are rarely over two mm long. Titanite is also common, occurring as very small, equant, transparent, reddish-orange crystals. Hematite is common as small blocky to this lustrous black crystals rarely over two mm in size. Tridymite is found in nearly every vesicle in some places and occurs as multiply twinned crystals up to one cm across. Phlogopite occurs as thin, transparent, light-brown crystals up to four mm across. Hollandite is locally abundant as black dendritic growths and coatings in vesicles and overgrowths on some of the other minerals.

The younger volcanics host a suite of zeolites and associated minerals that include:

erionite-offretite
heulandite
mesolite(?)
quartz
calcite

These minerals are more sparsely distributed but locally abundant. Heulandite and erionite-offretite occur as small euhedral crystals in vesicles. A minerals that resembles mesolite is sometimes found with calcite and quartz.

The localities examined so far have been in roadcuts or along stream banks. There are many unexplored hills, cliffs, and streams that may yield additional species.

--From the Thirteenth Annual New Mexico Mineral Symposium, November 14 and 15, 1992.

One-way road log starting near Mule Creek, New Mexico

0.0 Intersection of New Mexico Highway 180 and New Mexico Highway 78, about 45 miles northwest of Silver City, New Mexico. Turn west onto Highway 78 headed for the very small community of Mule Creek.

9.6 Mule Creek, New Mexico.

11.9 Now entering the Gila National Forest.

12.8 Intersection with Forest Road 111. Rockhounds like to collect small rounded pieces of obsidian, also known as apache tears, in the hills north of the highway between here and the state line.

15.4 Arizona-New Mexico State Line.

16.1 Area 1, Coal Creek. Turn off highway to left into flat parking area before stream crossing. Vehicles with high clearance or 4-wheel drive can drive up Coal Creek for a ways, but eventually you will have to walk. Hike up the creek bed as far as you wish, looking for boulders of vesicular rhyolite. Some of the rock is quite hard, so wear eye protection while using a hammer or sledge. At some point, the creek passes into New Mexico under a dilapidated barbed-wire fence that marks the state line. Continue up the creek as far as you wish. Good pseudobrookite and phlogopite, as well as other species, can be collected up and down the creek.

17.1 Area 2: an inconspicuous roadcut in a dense stand of pines. It is between the next two stream crossings after the picnic ground on the right. Parking is very limited. Look in vesicular rhyolite in the roadcut and in the stream below the road. This spot has very nice titanite, pseudobrookite, and hematite, as well as some u unidentified amber crystals.

18.1 Area 3: look for vesicular basalt in the roadcut in the hairpin bend of the road. Heulandite and calcite can be found here.

21.4 Area 4: this locality is easily recognized as a large, high roadcut of light-grey rhyolite. A large parking area is found on the left with spectacular views of Arizona to the west. The best tridymite has been found here as well as hematite, pseudobrookite, titanite, and hollandite.

21.7 Area 5: this area can be reached from area 4 by walking down the road and looking for talus composed of reddish-brown and black basalt accumulating from flows on the ridgetop. Heulandite, offretite (erionite?), quartz, and calcite have been found in the vesicles.

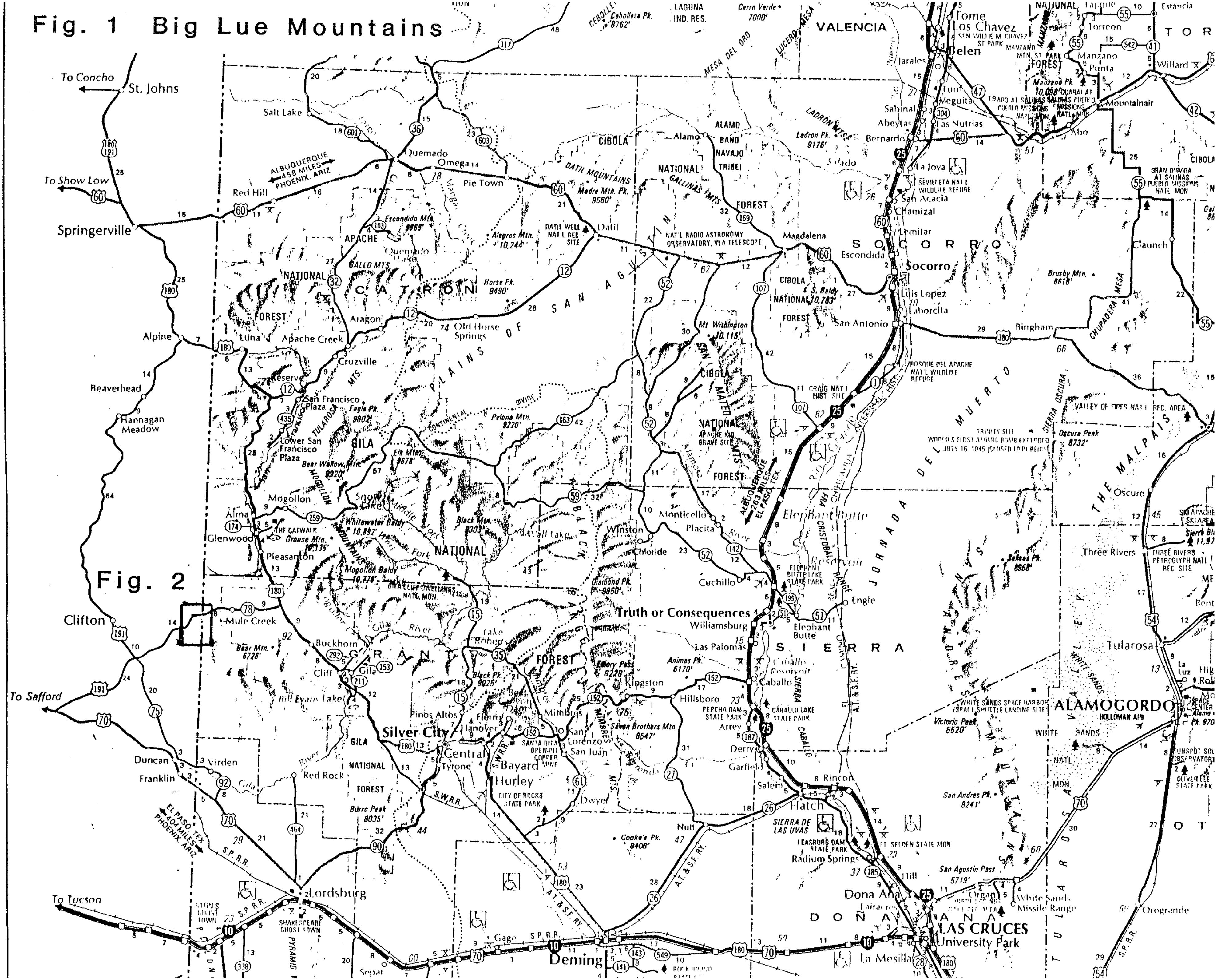
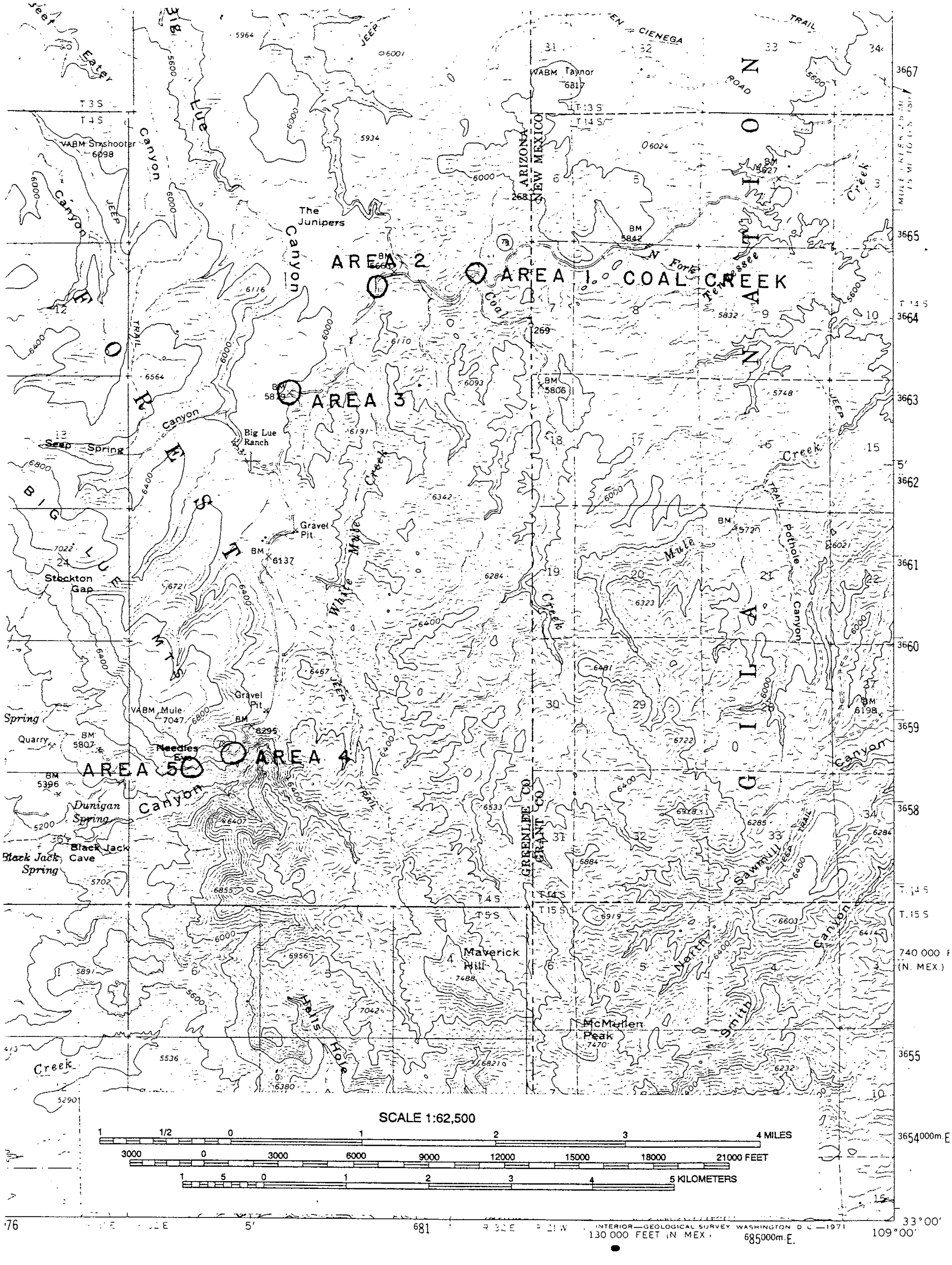


Fig. 1 Big Lue Mountains

FIGURE 2



AREA 1 COAL CREEK
AREA 2
AREA 3
AREA 4
AREA 5
The Junipers
Big Lue Ranch
Gravel Pit
Stockton Gap
Seep Spring
Dunigan Spring
Black Jack Cave
Black Jack Spring
Needles Eye
Maverick Hill
McMullen Peak
Hells Hole
ARIZONA
NEW MEXICO
GREENLEE CO
GRANT CO
CIENEGA ROAD
SCALE 1:62,500
4 MILES
21000 FEET
5 KILOMETERS
INTERIOR—GEOLOGICAL SURVEY WASHINGTON D C —1971
130 000 FEET (N MEX.)
685000m.E.
3654000m.E
33°00'
109°00'
740 000 FEET (N. MEX.)

MINERAL-COLLECTING GUIDE TO

EAST GRANTS RIDGE, NEW MEXICO

With round-trip road log from Grants
to collecting areas at East Grants Ridge

Total mileage: 20 miles

Mineral Collecting at East Grants Ridge

East Grants Ridge lies northeast of Grants, New Mexico, and is accessible throughout the year. The collecting area is located along paved Lobo Canyon Road. Garnets and topaz can be found in rhyolite boulders adjacent to the road. Apache tears have weathered out of the rhyolite and can be found by sifting through the soil. The more ambitious collector may wish to climb East Grants Ridge and try his/her luck looking among outcrops of the rhyolite. In addition to the maps (Figs. 1 and 2, pp. 4 and 5) the maps listed below may be helpful.

This is a short trip from Grants that requires only a two-wheel-drive vehicle.

SUGGESTED MAPS

Map Name	Scale	Available from
Cibola National Forest, Mt. Taylor Ranger District	½"=1 mile	Mt. Taylor Ranger Station (mile 2.5 in the road log)
Grants 7½' quadrangle	1:24,000	N.M. Bureau of Mines
Lobo Springs 7½' quadrangle	1:24,000	N.M. Bureau of Mines

Round-trip road log from Grants, New Mexico
to East Grants Ridge

0.00	McDonald's at the corner of Business I-40 and NM-53 (traffic light). Proceed east on Business I-40 through grants. 1.10
1.10	Traffic light. Grants Chamber of Commerce is on the left. 0.25
1.35	Traffic light. 0.05
1.40	Traffic light. Turn left onto 1st Street (NM-547). 0.40
1.80	Traffic light. 0.50
2.30	Stop sign. Turn right; follow signs leading toward Mt. Taylor. 0.20
2.50	Mt. Taylor Ranger Station is on the right. 0.20
2.70	Traffic light. Turn left onto Lobo Canyon Road (NM-547). 2.70
5.40	Prison entrance is on the right. 1.00
6.40	Cattle guard. 0.30
6.70	Cibola National Forest boundary. 2.65
9.35	Dirt road on the left is obscured by boulders. Continue to next dirt road on the left where there is enough room to turn around and park. Walk back to the collecting area on the right. 0.30
9.85	Collecting area. There is a road into the boulder area, the first dirt road mentioned above, but parking is difficult. Garnets, topaz and apache tears can be found in rhyolite boulders or on the ground. Retrace route to Grants. 9.85
19.70	Grants

FIGURE 1. Index map of the East Grants Ridge area.

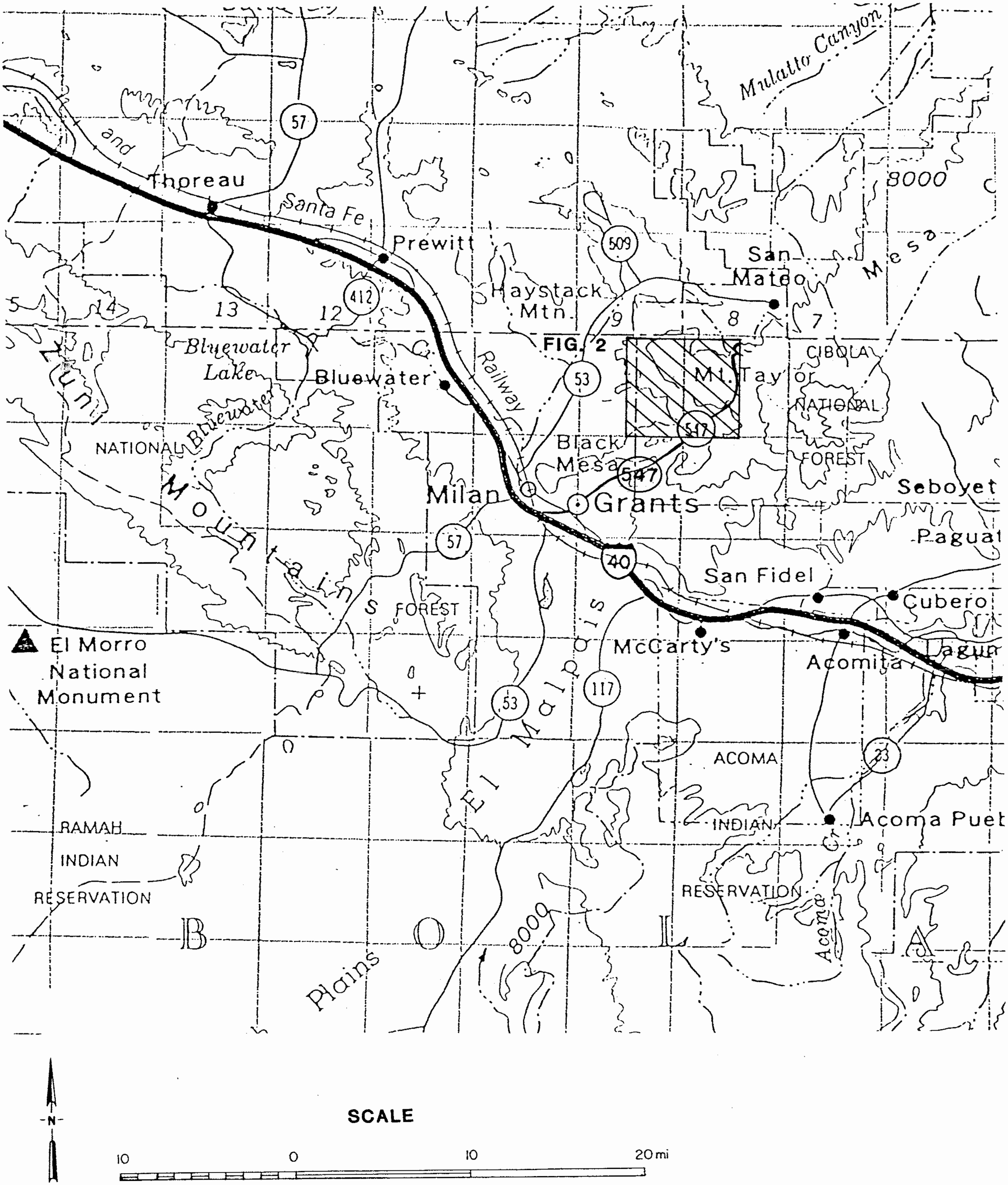
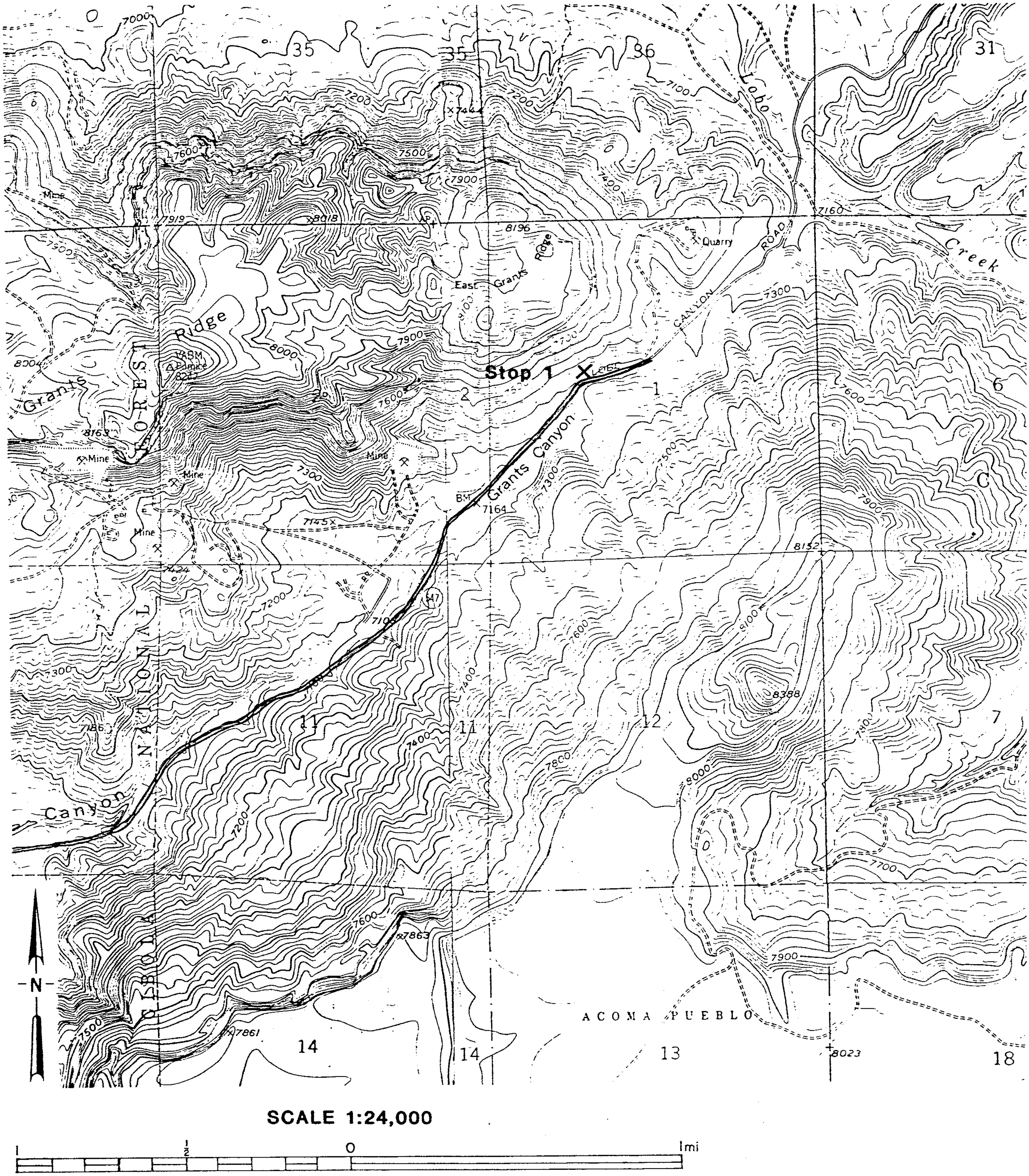


FIGURE 2. Map of the East Grants Ridge area.



Mineral-collecting guide to Kilbourne Hole area, Doña Ana County, New Mexico

Mark A. Ouimette
(University of Texas at El Paso)

With round-trip road log from El Paso to Kilbourne Hole.

Total mileage: 60 miles

ROAD LOG TO XENOLITH-COLLECTING LOCATIONS AT KILBOURNE HOLE MAAR, DOÑA ANA COUNTY, NEW MEXICO

This road log is adapted in part from the reports by Padovani and Reid (1989) and Hoffer et al. (1991). A xenolith is a foreign inclusion in an igneous rock. A maar is a low-relief, broad volcanic crater formed by multiple shallow eruptions. For a general summary of the geology of Kilbourne Hole maar, please consult Padovani and Reid (1989).

Kilbourne Hole is between the Basin and Range physiographic province and the North American craton along the western flank of the southern Rio Grande rift. This maar formed as alkaline mafic magma migrated rapidly from the mantle through the crust. A variety of igneous-mantle xenoliths were entrained with the magma and were erupted onto the surface in an explosive maar-forming event. The mantle xenoliths include various forms of spinel–olivine(=periodot)–clinopyroxene–orthopyroxene-bearing rocks known as peridotite, pyroxenite, and dunite. In addition, an array of crustal xenoliths are found with the mantle xenoliths.

Collecting conditions at Kilbourne Hole can be extreme with intense summer heat in excess of 100°F and freezing temperature in winter. Spring time, March in particular, can be very windy with violent dust storms. The monsoon season, from late July through August, is hot, wet, and accompanied by intense thunder-storm activity. Rattlesnakes are active in late spring through early fall and are especially active during the morning hours. They are found under bushes and under rocks especially below the maar rim. Collectors should bring extra food and plenty of water. No telephones, services, or facilities are available outside the Mesilla Valley so begin the trip with a full tank of gas.

Kilbourne Hole is on public land managed by the Bureau of Land Management (BLM) and no permits are required for collecting. It is requested that collecting be limited to personal use only so that the xenoliths will not be depleted by over-collecting.

Abstracts of talks on Kilbourne Hole peridot given at previous symposia are included after the road log.

SUGGESTED VEHICLES AND TRAVEL NOTES

Travel to Kilbourne Hole is by various county and BLM-maintained roads. Two-wheel-drive vehicles are satisfactory for travel there, but wet months may require four-wheel drive on occasion. Vehicles must remain on established roads in order to minimize destruction to the area. If you travel from Las Cruces, please do not attempt to take shortcuts to Kilbourne Hole unless you are already familiar with back roads in the Mesilla Valley–Kilbourne Hole area.

SUGGESTED MAPS

Name	Scale	Available from
El Paso, Texas–New Mexico–Chihuahua 30' x 60' quadrangle	1:100,000	NMBMMR or USGS
Kilbourne Hole 7½' quadrangle	1:24,000	NMBMMR or USGS

These maps were used to make Figs. 1 and 2, respectively, at the end of this collecting guide. Fig. 1 is a greatly reduced reproduction; the area on the original 1:100,000-scale map is clearer.

Round-trip road log from El Paso to Kilbourne Hole xenolith-collecting localities

Mileage	
0.0	Begin road log at the intersection of I-10 and Mesa Street in west El Paso, Texas (also marked as US-180 and Texas-20). You will pass several restaurants, stores, and gas stations in the first 0.5 mile, so take advantage of them if necessary. THERE WILL BE NO SERVICES AVAILABLE TO YOU SOON. **0.1**
0.1	Cross Osborn Street. Move into left lane. **0.4**
0.5	Cross Donaphin Street and railroad tracks. **0.7**
1.2	Cross Country Club Place. Sign will say North Texas Farm Road 260. **0.4**
1.6	Cross Montoya Road. **0.5**
2.1	Cross Rio Grande bridge. **0.5**
2.6	New Mexico State Line, continue straight on NM-184. **0.5**
3.1	Turn right on McNutt Road (NM-273). **1.8**
4.9	Turn left on Doña Ana County-A17 toward Santa Teresa airport. **2.2**
7.1	You are now on La Mesa surface, which is a sand dune here that represents the upper surface of the Rio Grande rift basin-fill deposits. **0.3**
7.4	Turn left onto road between two factories, the one on your left has a white stripe and the one on your right has a pink stripe. Head toward the railroad-track crossing. **0.4**
7.8	Cross over railroad track and in 165 ft turn right onto dirt road (A17). **0.8** **CAUTION** Drive with extra caution on these dirt roads because they are narrow, have many curves, and you are likely to encounter traffic that is moving at high speed. This road will parallel the track for about 10 miles.
8.6	Pass Doña Ana-AO3, stay on A17. **0.6**
9.2	Cross red metal cattle guard. **1.2**
10.4	Cross unmarked road. **2.6**
13.0	Cross under power lines. **0.5**
13.5	Cross unmarked road that also crosses over the railroad tracks. **0.5**
14.0	Cross gray metal cattle guard. Doña Ana-A14 heads southwest from here to JCJ Ranch and East Potrillo Mountains. This road will take you to Hunt's Hole maar and to Kilbourne Hole also. There are few if any xenoliths left at Hunt's Hole. This road is the wet-weather alternative mentioned at mileage point 24.7. **4.1**
18.1	Cross red cattle guard marked with a number 3. **0.4**
18.5	Cross unmarked road that crosses over railroad track. **0.1**
18.6	Turn left (southwest). **2.5**
21.1	Cross unmarked road. You can clearly see the tuff ring (rim) of Kilbourne Hole straight ahead. **0.7**
21.8	Cross orange (rusted) cattle guard. **0.8**
22.6	Cross unmarked road. A USGS bench mark is located here. **2.1**
24.7	Cross unmarked road. This is not a BLM road so please stay on the BLM roads. The next mile ahead is often muddy during the late July and August monsoon season and winter rainy periods. If the road looks impassable, return to mileage point 14.0 and take that road around Hunt's Hole to Kilbourne Hole. **0.9**
25.6	Cross yellow cattle guard. **0.7**
26.3	Cross road that heads to the water tank on the right. **THIS WATER IS UNSAFE TO DRINK** unless treated. Another USGS bench mark is located near the tank. **0.4**
26.7	Turn left to see the Kilbourne Hole overlook. You will return to this point soon. **0.1**

26.8 Turn right to Kilbourne Hole overlook (marked A on Fig. 2). When leaving this location, you need to return to mileage point 26.3, road-log mileage continues from the overlook. Turn left as you leave the overlook. **0.1**

26.9 Turn left. **0.1**

27.0 Turn left following the rim to the xenolith-collecting locations (marked B, C, and D on Fig. 2). **0.7**

27.7 Cross yellow cattle guard and turn left back toward the rim. **0.4**

28.1 Road on left goes to collecting area marked B on Fig. 2. **0.8**

28.9 Road on left goes to collecting area marked C on Fig. 2. **0.6**

29.5 Dead end at range fence. Trail to left leads to collecting area marked D on Fig. 2. HAPPY COLLECTING.
To leave Kilbourne Hole just retrace your way back to El Paso. **29.5**

59.0 El Paso.

References

Hoffer, J. M., Chen, W., McLemore, V. T., and Anthony, E. Y., 1991, Day 2: The Potrillo volcanic field (road log); *in* Julian, B., and Zidek, J. (eds.), Field guide to geologic excursions in New Mexico and adjacent areas of Texas and Colorado: New Mexico Bureau of Mines and Mineral Resources, Bulletin 137, pp. 12-20.

Northrop, S. A., 1959, Minerals of New Mexico: Albuquerque, University of New Mexico Press, p. 381.

Padovani, E. R., and Reid, M. R., 1989, Field guide to Kilbourne Hole maar, Doña Ana County, New Mexico; *in* Chapin, C. E., and Zidek, J. (eds.), Field excursions to volcanic terrains in the western United States, volume 1: Southern Rocky Mountain region: New Mexico Bureau of Mines and Mineral Resources, Memoir 46, pp. 174-179.

—From the 11th New Mexico Mineral Symposium, 1990

KILBOURNE HOLE MAAR PERIDOT, DOÑA ANA COUNTY, NEW MEXICO

John R. Fuhrbach, 3133 Fleetwood, Amarillo, TX 79109

Peridot occurs in explosion debris from a 25,000-year-old volcano as small, but brilliant gems in a wide color range. Unlike peridot found elsewhere in the Southwest, peridot in the Kilbourne Hole maar is found in elliptical "xenolith bombs" of volcanic origin ranging from 2 to approximately 40 cm long. In chemistry, color, density and hardness, optical properties and PIXE (Proton Induced X-ray Emission) analysis, the Kilbourne peridot is similar to the San Carlos, Arizona material except for the greater color range in Kilbourne material and a characteristic inclusion not heretofore described in gemological literature. The R.I.-S.G. color relationship is reviewed with regard to Mg:Fe ratio and the effect of heat treatment and irradiation. The future of this material as a source of the seldom-seen greenish-yellow "chrysolite" peridot is discussed. Comparisons made with other documented worldwide sources add to the cumulative knowledge we have concerning peridot as a gem material.

—From the 12th New Mexico Mineral Symposium, 1991

FACETABLE STONES OF NEW MEXICO

Merrill O. Murphy, 7304 Union St. NE, Albuquerque, NM 87109

Peridot—New Mexico probability quite good. Best chances are: 1) in Kilbourne Hole and other similar features near Afton in Doña Ana County and near the Mexican border—small but good greens; 2) in McKinley County in the Red Lake, Green Knobs, Todilto Park, and Zilditloi Mountain areas—some good rough; 3) rumor has it that good finds are presently being made at a volcanic neck south of Engle in Sierra County; and 4) an occasional find is possible in other counties where large phenocrysts have been noted in volcanic rocks.

FIGURE 1. Index map of El Paso--Kilbourne Hole area.

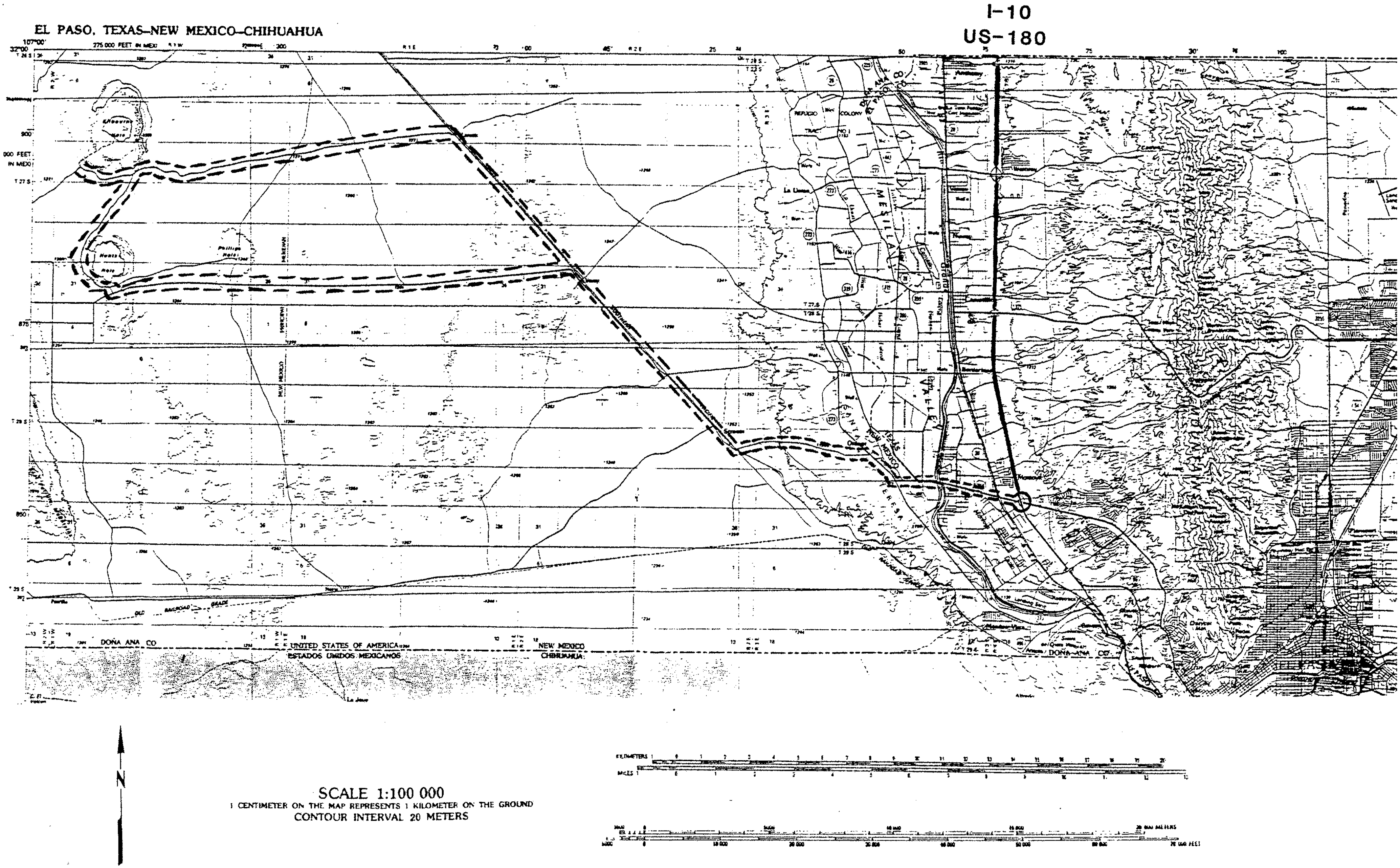
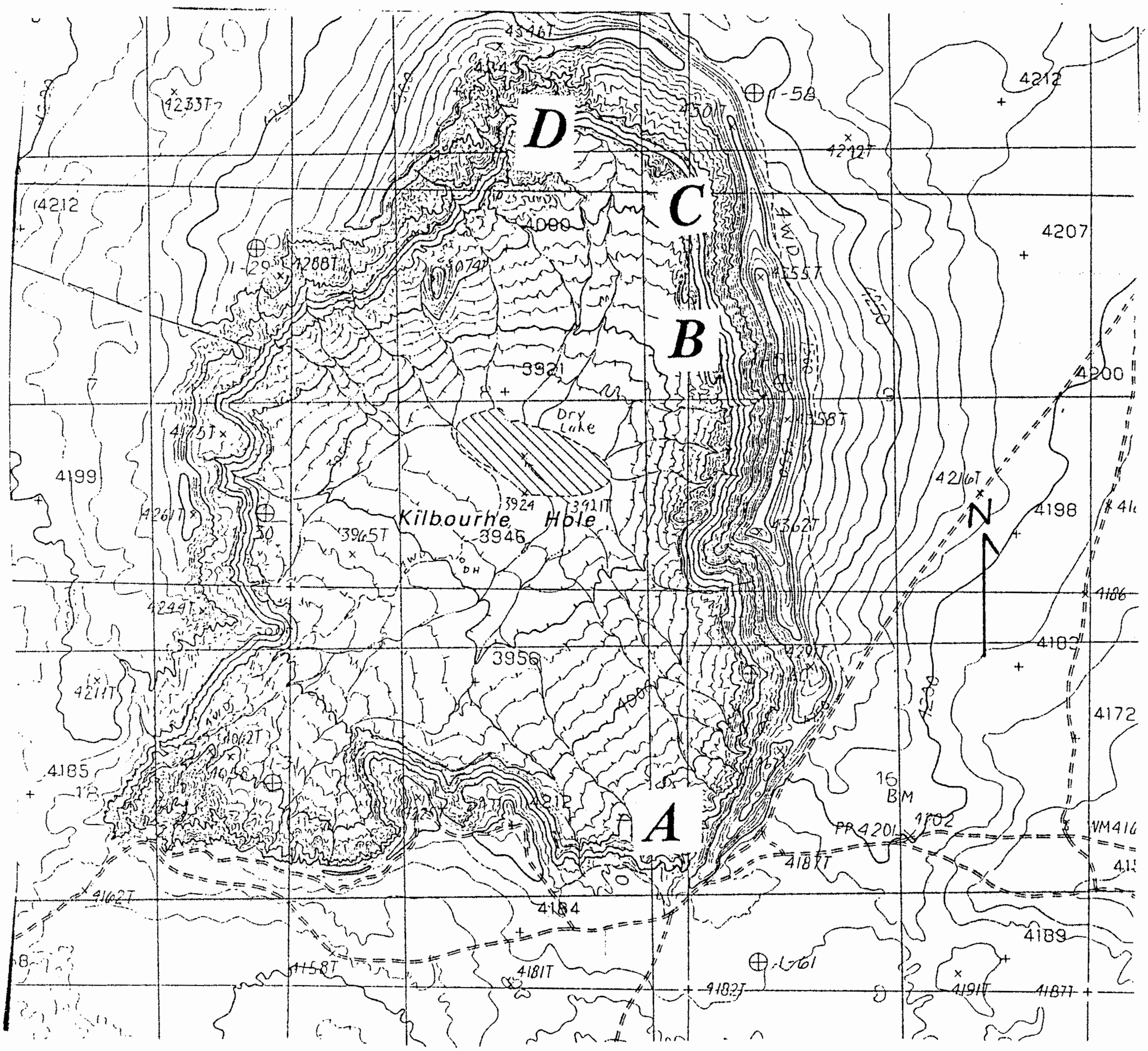


FIGURE 2. Kilbourne Hole overlook (A) and xenolith-collecting locations (B, C, and D).



SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET

SUPPLEMENTAL CONTOUR INTERVAL 5 FEET

Mineral collecting guide to

Gonzales mine, Socorro County, New Mexico

V. T. McLemore and M. L. Wilson

with round-trip roadlog from Socorro
to the Gonzales mine

Total mileage: 23 miles

Mineral collecting at the Gonzales mine

The Gonzales prospect is located in NE¼ sec. 2, T3S, R1E, in Socorro County, New Mexico, at an elevation of 5,180 feet. Three adits and numerous pits penetrate a Tertiary vein system of Precambrian granite. The major minerals at this site consist of fluorite in colorless to green cubes and octahedrons and barite platy crystals. Lesser amounts of galena and quartz are also present. Many of the specimens are iron stained. The district produced a total of 50 tons of fluorite (McAnulty, 1978, NMBMMR Memoir 34). In addition to the maps (Figs. 1 and 2, pp. 5 and 6) the maps listed below may be helpful.

A 4-wheel-drive vehicle is recommended for following the roadlog. Care should be taken that vehicles not stop in sandy arroyos; it is easy to become stuck. Seasonal erosion may leave large deep holes in the tracks. Remember to confine collecting activities to surface workings only because the underground workings can be extremely dangerous; always leave gates as you find them.

Suggested maps

Name	Scale	Available from
Loma de las Cañas 7.5′ quadrangle	1:24,000	NM Bureau of Mines and Mineral Resources
Socorro 7.5′ quadrangle	1:24,000	NM Bureau of Mines and Mineral Resources

Round-trip roadlog from Socorro, New Mexico
to the Gonzales mine, Socorro County, New Mexico

0.0 Starting point: traffic light at corner of California and College, Pizza Hut on corner. Proceed north. 0.5

0.5 Freeway entrance; continue north on I-25. 1.9

2.4 Exit 152 to Escondida. 0.2

2.6 Stop sigh: turn right. 0.2

2.8 Road junction; turn left onto unmarked NM-408. 1.3

4.1 Escondida Lake turn-off; turn right onto Pueblito road. 0.1

4.2 Railroad tracks; continue past Escondida Lake. 0.2

4.4 Cross Rio Grande. 0.1

4.5 Pavement ends; continue on graded dirt road. 0.4

4.9 Road junction; turn right and follow winding road. 1.0

5.9 Road junction with "Reflexology" sign; bear right. 0.4

6.3 Road junction; bear left. 0.2

6.5 Cattle guard. 0.3

6.6 JR Ranch and Jolley Welding Service; continue straight. 0.1

6.7 Road junction; continue straight, then right at the fork. 0.1

6.8 Cattle guard. 0.3

7.1 View of valley and mountains to the west. 0.2

7.3 Turn left into arroyo at rock-cairn marker and follow track up arroyo. DO NOT STOP IN SAND BECAUSE IT IS EASY TO GET STUCK. 0.3

7.6 Cross arroyo. 0.1

7.7 Fork in track; bear right. 0.3

8.0 Cross arroyo. 0.1

8.1 Scenic overlook: west across the valley, north to Cerrillos del Coyote. 0.4

8.5 Turn left to gate with "Wilderness Study Area" sign. Proceed through the gate and close it behind you. 0.3

8.8 Top of hill; Abo red beds to the north. 0.2

9.0 Track splits at bad, washed-out place; take right-hand brushy route on high side of track. 1.6

10.6 Track junction; bear right. Drive over weathered Pennsylvanian limestone. 0.3

10.9 Track junction; bear right. 0.2

11.1 Track junction; bear right. 0.2

11.3 Gate; proceed through and leave gate as you found it. 0.2

11.5 Gonzales mine site to left and ahead in Precambrian granite. Specimens will be found on the surface. UNDERGROUND WORKINGS CAN BE EXTREMELY HAZARDOUS. Fossiliferous limestone on slopes to the west. Retrace route back to Socorro. 11.5

23.0

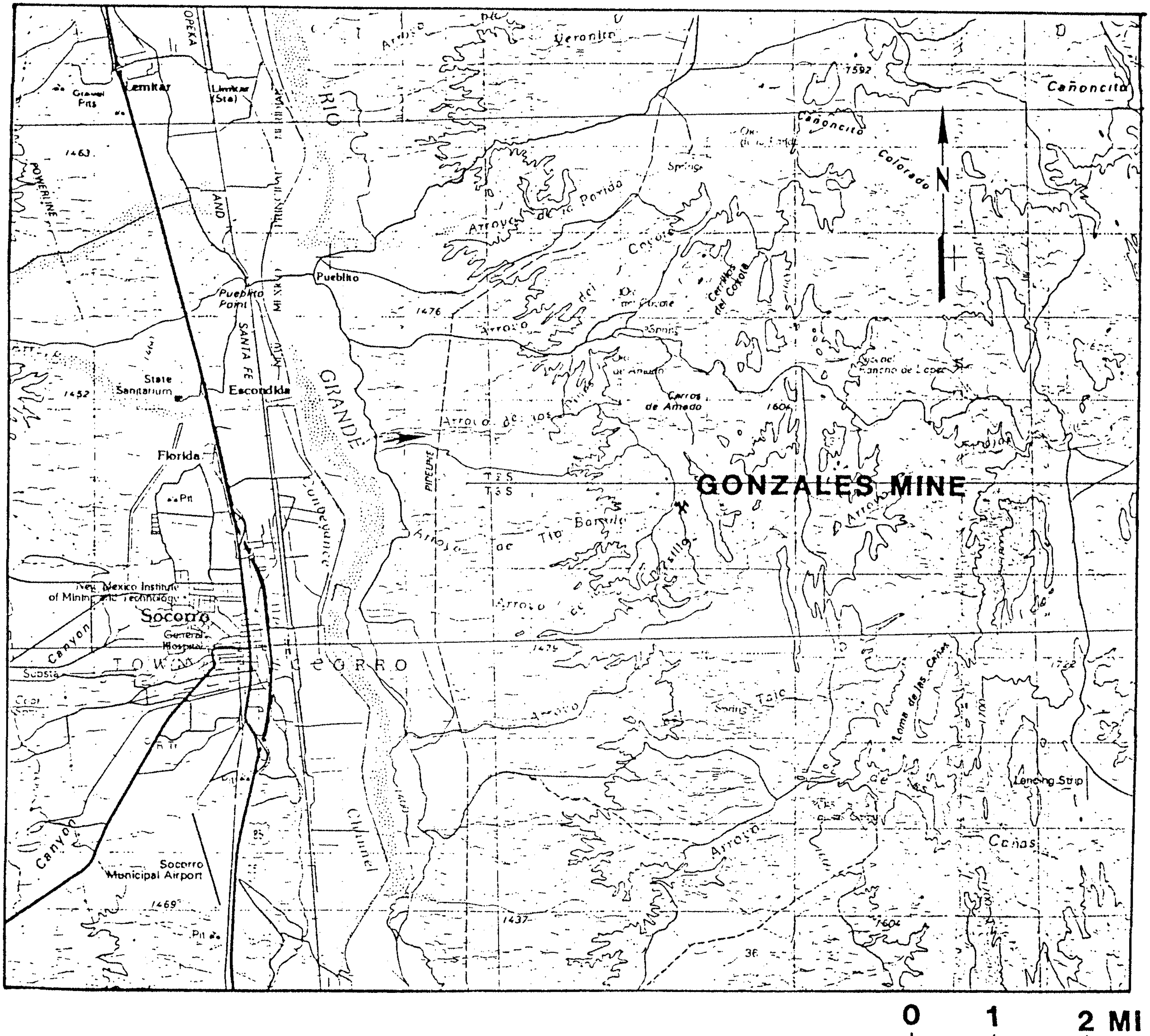


FIGURE 1 LOCATION MAP

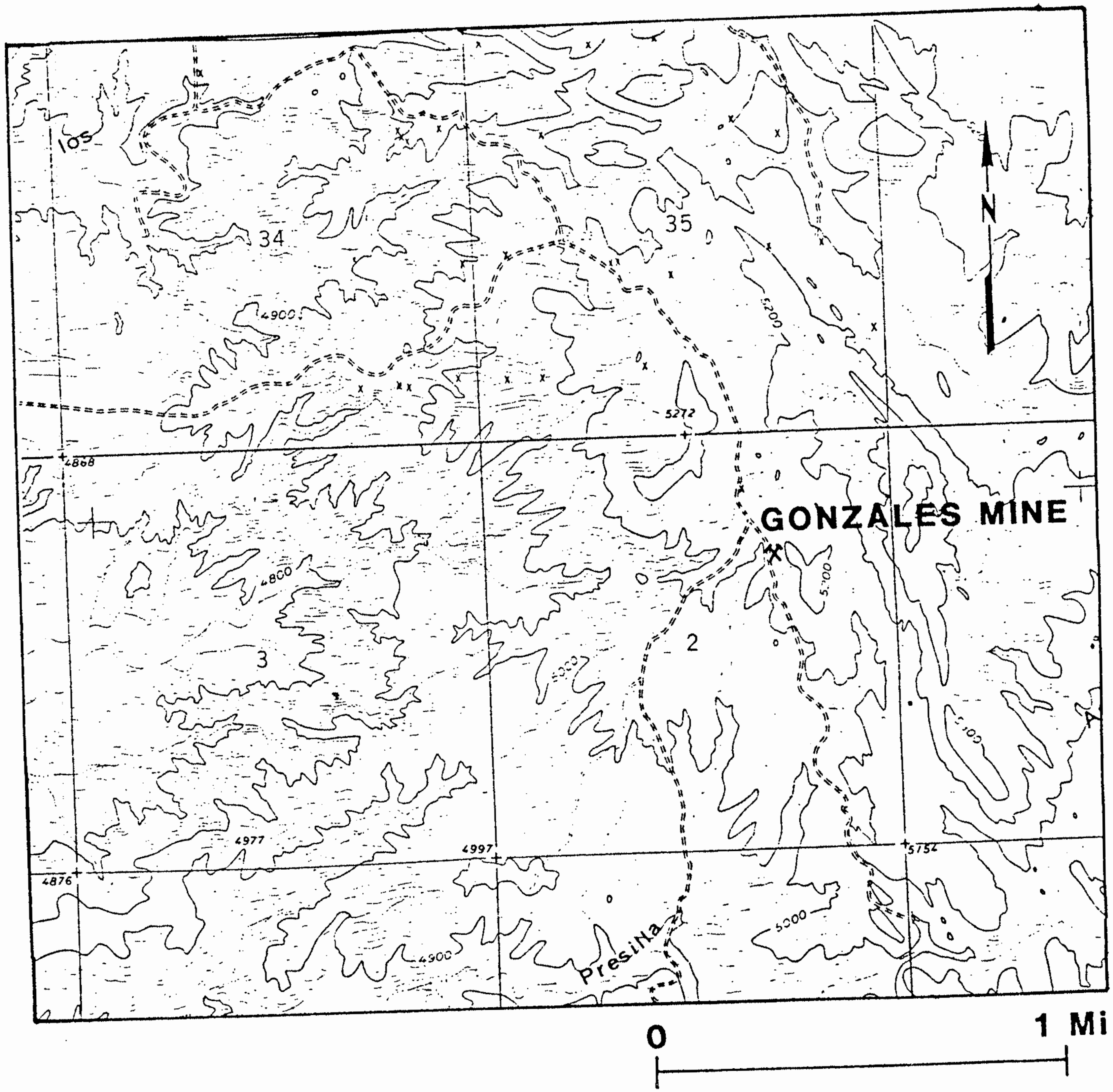


FIGURE 2 DETAILED MAP

MINERAL-COLLECTING GUIDE TO THE ZUNI MOUNTAINS FLUORSPAR DISTRICT, NEW MEXICO

With round-trip road log from Grants
to prospects in the Zuni Mountains

Total mileage: 74 miles

Mineral Collecting in the Zuni Mountains

V. T. McLemore, K. B. Brown, and R. M. North
New Mexico Bureau of Mines & Mineral Resources
New Mexico Institute of Mining & Technology
Socorro, New Mexico 87801

The Zuni Mountains are not well known as a mineral-collecting locality even though some nice fluorite specimens and slabbing material are commonly found in the area. The collecting sites are located in the Cibola National Forest, Mt. Taylor district; the road log can be divided into two independent trips. Coming after the road log is an abstract of a paper given at the 6th N.M. Mineral Symposium. In addition to the maps (Figs. 1-3, pp. 8-10) the maps listed below may be helpful.

The trip can be made in dry weather by two-wheel-drive vehicles.

SUGGESTED MAPS

Map name	Scale	Available from
Cibola National Forest, Mt. Taylor Ranger District	½"=1 mile	Mt. Taylor Ranger Station in Grants
Arrosa Ranch 7½' quadrangle	1:24,000	N.M. Bureau of Mines
Ice Caves 7½' quadrangle	1:24,000	N.M. Bureau of Mines
Post Office Flat 7½' quadrangle	1:24,000	N.M. Bureau of Mines

Round-trip road log from Grants, New Mexico,
to prospects in the Zuni Mountains

PART I: Grants to Section 21 mine

0.00	McDonald's at corner of Business I-40 and NM-53 (traffic light). Proceed south on NM-53. 0.20
0.20	Junction with I-40 East. 0.10
0.30	Junction with I-40 West. 0.30
0.60	Junction with Zuni Canyon Road on right. Continue south on NM-53. 2.20
2.80	Outcrop of San Andres Limestone is on right. 5.10
7.90	San Rafael Mesa is on right. 6.10
14.00	Pass through basaltic lava beds. 2.70
16.70	Junction with Forest Road 447. 3.10
19.80	At milepost 67 the road cut passes through Precambrian gneissic granite. 0.30
20.10	Junction with road leading to Section 27 mine (private property). Continue on NM-53. 0.80
20.90	Large road cut passes through gneissic granite. 0.20
21.10	Dim dirt road on right leads to Section 21 shaft. Continue on NM-53. 0.20
21.30	Turn right onto dirt road; go through gate. Follow road to pits. 0.55
21.85	Road continues uphill. Vehicle with high-ground clearance and four-wheel drive may be desirable; it is also possible to park here and hike the 0.85 mi to the collecting area. 0.05
21.90	Road forks. Continue right. Mine dumps along road. 0.10
22.00	BAD STRETCHES OF ROAD AHEAD. 0.60
22.60	Dumps; park here for STOP 1. 0.10
22.70	STOP 1. Shaft by road. The dumps contain good fluorspar specimens. Workings and other dumps are toward the top of the hill (to left) and farther up the road. Return to NM-53. 1.40
24.10	NM-53; turn left to return to Grants or turn right to continue to the Mirabel mine (road log follows).

PART II: Section 21 mine to Mirabel mine

0.00	Turn right onto NM-53 from the road to the section 21 mine. 1.50
1.50	Road cut passes through basalt. 1.40

2.90	Lava flow is on the left. 1.00
3.90	Cinder cone is on the right. 0.30
4.20	Cinder quarry is on the right. 0.10
4.30	Road on left leads to Ice Caves. Continue on NM-53. 0.20
4.50	Cerro Bandera is on the left. 0.40
4.90	Road cut passes through Permian sediments. Cross over Continental Divide, elevation 7882 ft. 1.20
6.10	Road cut. 0.20
6.30	Turn right onto Forest Road 50 (dirt road). This road may be impassable in wet weather. 1.55.
7.85	Road forks; continue to the right on FR-50. Oso Ridge Lookout Road is to the left. 0.50
8.35	Road curves. Cinders are on the left. 1.75
10.10	Cattle guard. 0.50
10.60	Cattle guard. 0.05
10.65	Bear left on FR-50 at the junction of FR-50 and the cutoff to FR-49. 0.15
10.80	Second junction with FR-49. Continue on FR-50. 0.30
11.10	Cattle guard. 0.3
11.40	Permian Abo Formation is to the left. 0.30
11.70	Cattle Guard. 1.10
12.80	Junction of three roads. Continue straight ahead. 0.70
13.50	Cattle guard. 1.15
14.65	Cattle guard; sigh reads "Entering private land". 0.45
15.10	Cabin is on the right. 0.70
15.80	Sign reads "Entering private land". 1.00
16.80	Bear right at junction with Forest Road 548. 0.20
17.00	Agua Fria Creek. 0.20
17.20	Cattle guard. 0.40
17.60	Cattle guard. 0.80
18.40	Cattle guard. 0.70
19.10	Entering Copperton Canyon. 1.10
20.20	Junction with a road to the right. Continue ahead. 1.35
21.55	Entering Post Office flat. 0.05
21.60	Campground is on the left. 0.10
21.70	Turn right at the junction with FR-480. 0.10
21.80	Bear left on FR-178 at the junction of FR-178 and 480. 1.40
23.20	Road curves. Diener copper mine may be seen in the distance ahead. 0.10

23.30	Junction with Diener copper mine road. Continue straight ahead on FR-178. 0.80
24.10	Cattle guard. 0.90
25.00	Turn left onto dirt road. 0.10
25.10	There are some prospects on the right. 0.20
25.30	Road forks; stay right. There is a prospect on the left. 0.30
25.60	There is a prospect on the left. 0.10
25.70	There is a prospect on the right. 0.15
25.85	STOP 2. Both prospects, on either side of the road, yield nice specimens of fluorite and barite with copper minerals. Turn around to return to FR-178. 0.15
26.00	Turn left at the junction and take the steep road down toward FR-178. 0.20
26.20	Turn left at the junction with FR-178. 0.10
26.30	Turn right at the next junction. Bear left after the turn. 0.15
26.45	STOP 3. Dumps from lower Mirabel mine. Park. The dumps provide nice fluorite and barite specimens. Return to FR-178. 0.15
26.60	Turn right on FR-178. 0.60
27.20	Road cut passes through Abo Formation. 1.20
28.40	Turn right onto FR-180. 2.00
30.40	Entering Prop Canyon. 2.10
32.50	Cattle guard. 0.95
33.45	Junction with FR-425. Continue on FR-180. 1.40
34.85	Cattle guard. 2.25
37.10	Cattle guard. 1.20
38.30	Cattle guard. 3.60
41.90	Cattle guard. 0.20
42.10	Bridge over I-40. Paved road (NM-518). 0.45
42.55	State highway compound. 0.65
43.20	Sawmill. 0.30
43.50	Cattle guard. 0.10
43.60	Turn right toward Milan at the stop sign at the junction with NM-122. 2.00
45.60	Milan city limits. 0.35
45.95	Traffic light at the junction with Ambrosia Lake Road. 0.15
46.10	Traffic light. 0.75
47.85	Bridge over railroad. 0.85
48.70	Traffic light. McDonald's on left.

Mineral collecting in the eastern Zuni Mountains,
Cibola County, New Mexico

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The Zuni Mountains near Grants in northwestern New Mexico are not well known as a mineral-collecting locality even though some nice specimens of fluorite, Barite, and copper oxides have been found. The eastern mountains contain Precambrian veins and Paleozoic stratabound sedimentary copper deposits that have produced more than 30,000 lbs of copper, 260 oz of silver, and 2 oz of gold. However, the most important production in this area came from veins that produced more than 192,000 tons of fluorspar ore from 1909 to 1962. Thus, the eastern Zuni Mountains contain one of the largest fluorspar districts in the state.

Fluorite with subordinate amounts of quartz, calcite, and, rarely, barite and galena occurs in veins up to 7 ft wide and several thousand ft long. The veins typically intrude Precambrian gneissic granite, although a few fluorite veins intrude Paleozoic sedimentary rocks. The veins are concentrated in two major areas, one near the mines in sections 21 and 27 and the other at the Mirabel mine in Diener Canyon.

Blue, purple, green, and colorless cubes of fluorite up to 1/2 inch across are common in both areas. Specimens of small stacked fluorite cubes sometimes exhibit an iridescent or pearly luster. Massive, banded, blue and green fluorite provides nice slabbing material and can be found in veins near the sections 21 and 27 mines. Some banded fluorite also occurs at the Mirabel mine. Clusters of bladed pink- to salmon-colored barite, occasionally with fluorite, occur near the Mirabel mine. Some of the specimens near the Mirabel also contain blades of malachite with fluorite and barite.

Many of the fluorspar deposits occur on national forest land and are readily accessible to the public. Mineral collectors should be careful, because many of the underground workings are extremely hazardous. Good material can be obtained from mine dumps and shallow open trenches.

FIGURE 1. Index map of the Zuni Mountains area.

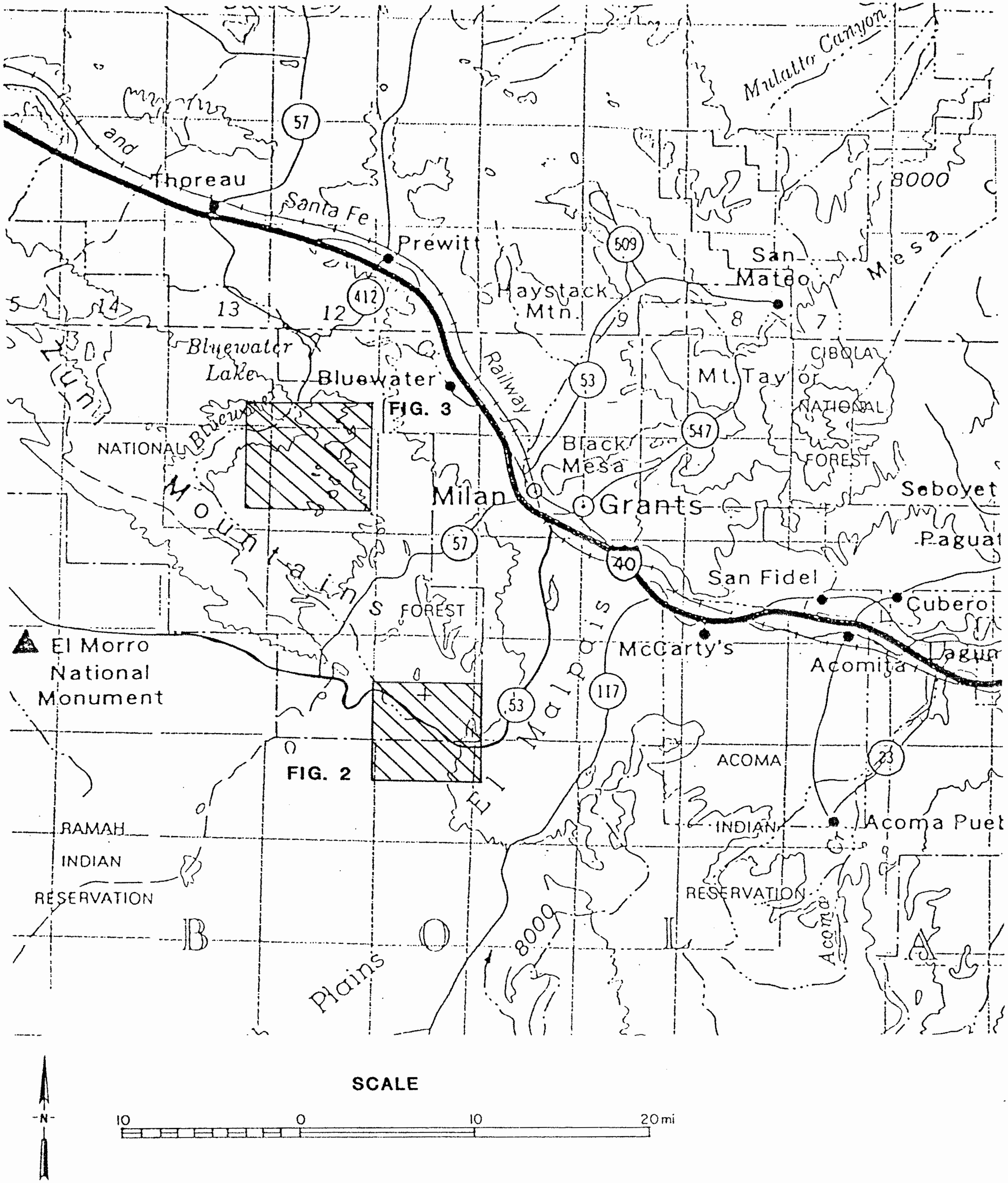


FIGURE 2. Map of the Sec. 21 Mines area.

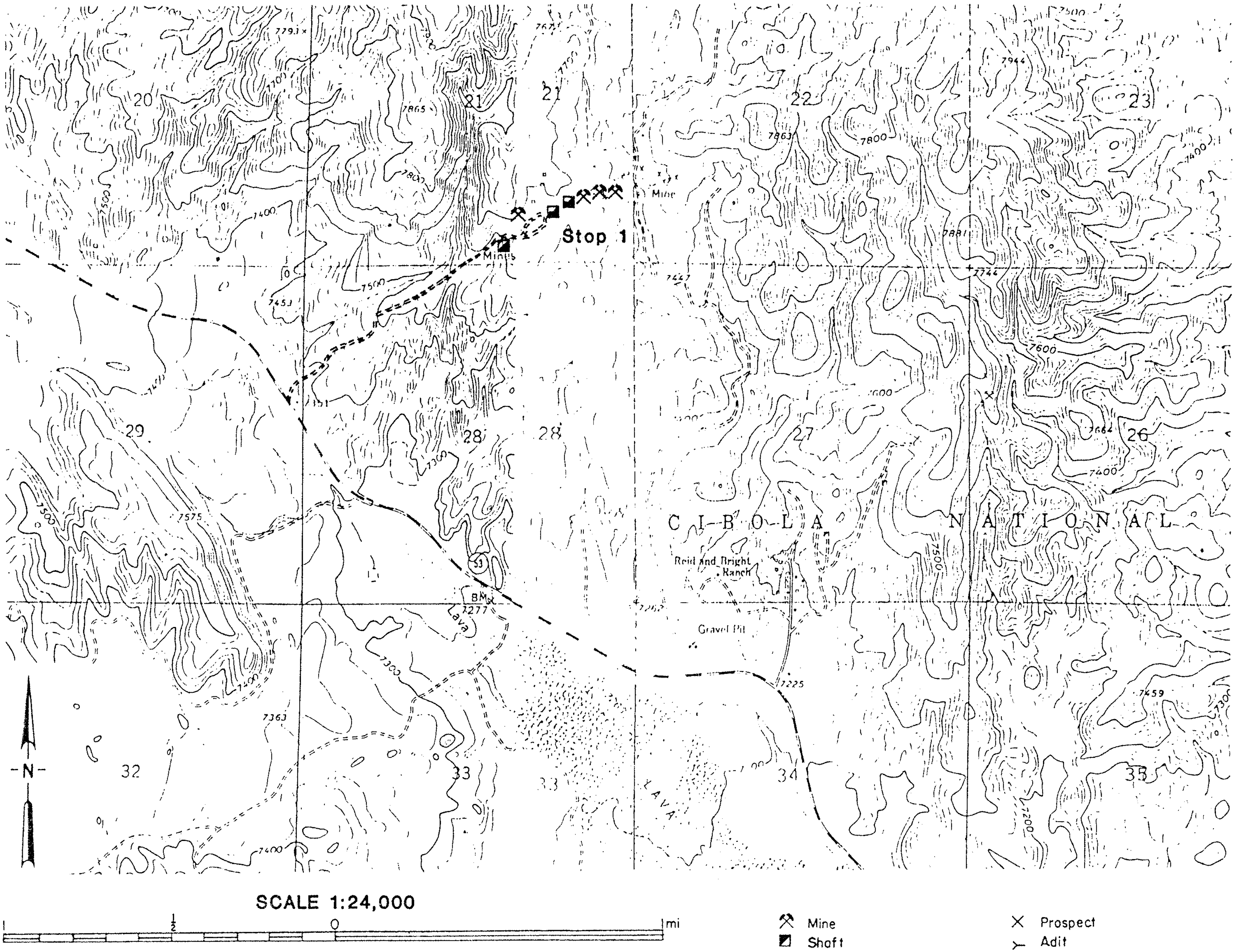
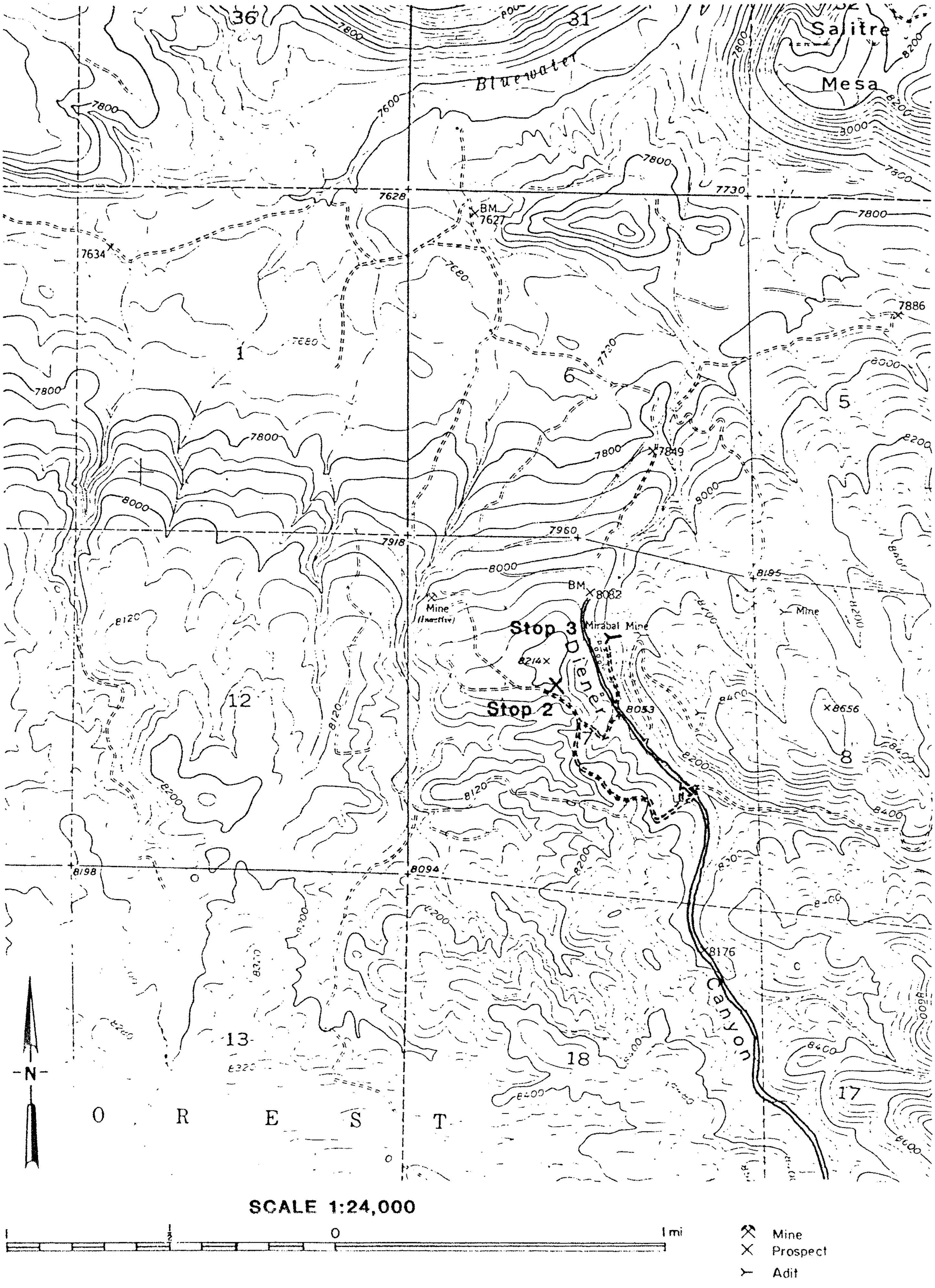


FIGURE 3. Map of the Mirabel Mine area.



FIELD TRIP GUIDE TO THE

JONES CAMP MINING DISTRICT

With round-trip road log from Socorro to
prospects in the Jones Camp mining district
Socorro County, New Mexico

Total mileage: 108 miles

The Jones Camp mining district has produced attractive and interesting "micros" of sphene. In addition, magnetite, actinolite, and apatite can be found. The best sphene crystals are found in the metamorphosed limestone near the Jones Camp dike. They can also be found in the dike itself.

In addition to the maps (Figs. 1 and 2, pp. 5 and 6) the maps listed below are helpful.

The trip takes the better part of a day and can be made in a two-wheel drive vehicle during the dry season.

SUGGESTED MAPS

Map Name	Scale	Available from
Cooper Canyon 7½' quadrangle	1:24,000	N.M. Bureau of Mines
Pink Peak 7½' quadrangle	1:24,000	N.M. Bureau of Mines

Round-trip road log from Socorro to prospects
in the Jones Camp mining district

0.00	Stoplight at the intersection of California St. and College. Drive south on California. 0.45
0.45	Stoplight. Continue south on California. 0.20
0.65	Stoplight. Continue south on California. 0.25
0.90	Junction with US Highway 60 west. Continue south on California. 0.50
1.40	Intersection with NM Highway 1 south. Bear left. Prepare to enter Interstate 25. Stay in the right lane. 0.25
1.65	On-ramp to I-25. 0.25
1.90	Yield. Enter I-25. 0.50
2.40	Bridge. Bald peak on skyline to the right (west) is South Baldy, highest point in the Magdalena Range and in Socorro County - 10,783 ft. 6.40
8.80	Sign, "Exit 139, San Antonio, Carrizozo. Exit 1 mile." Prepare to exit. 0.95
9.75	Take Exit 139 to US Highway 380 East. 0.40
10.15	Bridge over Walnut Creek. 0.65
10.80	Enter San Antonio, New Mexico, "Home of the Owl Bar." 0.25
11.05	Junction with NM Highway 1. The Bosque del Apache Wildlife Refuge is 8 miles south on Highway 1. Continue east on US 380. 0.35
11.40	Railroad. 0.70
12.10	Rio Grande. 5.50
17.60	Fite Ranch Road (Socorro County Road A153). Cretaceous fossils can be collected in this general area. The old coal mining towns of Carthage and Tokay are about 1 mile south and east of this intersection. You will be able to see, ahead on the right, some of the dumps of the old coal mines. Continue east on US 380. 4.20
21.80	NM Highway 525 to Stallion Site on the White Sands Missile Range. Continue east on US 380. You are now crossing the northern end of the Jornada de Muerto (Journey of the Dead). 9.80
31.60	Rest area on right. 0.80

32.40 Rest area on right. Mountain range ahead and trending to the right (south) is the Sierra Oscura. Oscura is Spanish for "dark" or "heavily shaded." 5.95

38.35 Enter Bingham. Prepare to turn left ahead. 0.40

38.75 Entrance to Blanchard Rock Shop. 0.15

38.90 Turn left (north) off US 380. The road on the right past the Bingham Post Office leads to the Hansonburg mining district. The Hansonburg district (Bingham, Blanchard claims) has produced some of the finest mineral specimens from New Mexico, including fine specimens of linarite, brochantite, cyanotrichite, spangolite, mondochite, galena, barite, and fluorite. The claims are currently (1983) held by Western General Resources. Mineral collecting trips are allowed occasionally. Arrangements should be made through Dean Duke of Lemitar, NM. The ore deposits are Mississippi Valley-type, deposited as open-space filling in Pennsylvanian limestone (Putnam and others, 1983). 0.30

39.20 Cross draw. 0.05

39.25 Road on left leads to Orndorff ranch. Continue north. 0.35

40.60 Cattle guard. 0.80

41.40 Cattle guard. Begin to turn to right. 0.95

42.35 Road forks. Continue on left fork. 1.55

43.90 Road to left. Continue east. 2.00

45.90 Cattle guard. Chupadera Mesa ahead. 0.60

46.50 Cross draw. 0.90

47.40 Begin furn to left. SLOW! Prepare to turn right. 0.05

47.40+ Turn right.

47.45 Gate. Continue through gate. LEAVE GATE AS YOU FIND IT. (It will probably be closed.) 1.45

48.90 Water tank on right. Road curves left ahead. 2.00

51.90 Gate. 1.00

52.90 Gate. 1.10

54.00 Jones Camp. The Jones Camp district is an iron mining camp which has been the focus of periodic interest, but little or no production has resulted (Kelley, 1949). Minerals from the district include magnetite, apatite, actinolite, and sphene. Some nice honey-colored sphene "micros" have come from the district. The major ore deposits of the district are located along a monzonite dike intruding the Permian Yeso Formation (Kelley, 1949). The deposits are probably contact metasomatic, but recent work has suggested alternative possibilities (Gibbons, 1981).

Retrace route to Socorro.

108.0 Socorro

REFERENCES

Gibbons, T. L., 1981, Geochemical and petrographic investigation of the Jones Camp magnetite ores and associated intrusives, Socorro County, NM: M.S. thesis, New Mexico Institute of Mining and Technology

Kelley, V. C., 1949, Geology and economic of New Mexico iron-ore deposits: University of New Mexico, Publications in Geology, No. 5, 246 pp.

Putnam, B. R., Norman, D. I., and Smith, R. W., 1983, Mississippi Valley-type lead-fluorite-barite of the Hansonburg mining district: New Mexico Geological Society Guidebook 34, p. 247-252

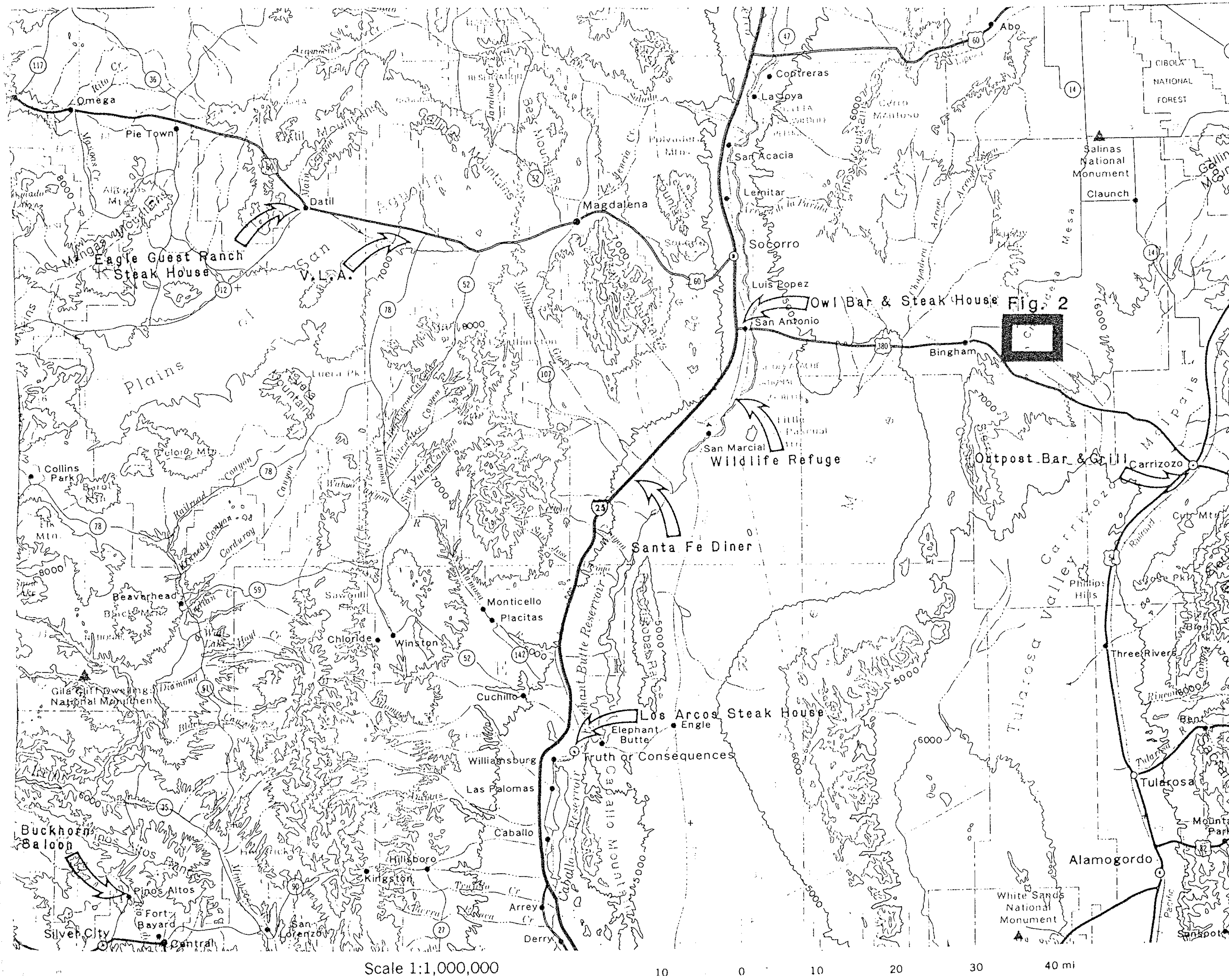


Figure 1. Index map of the Socorro area.

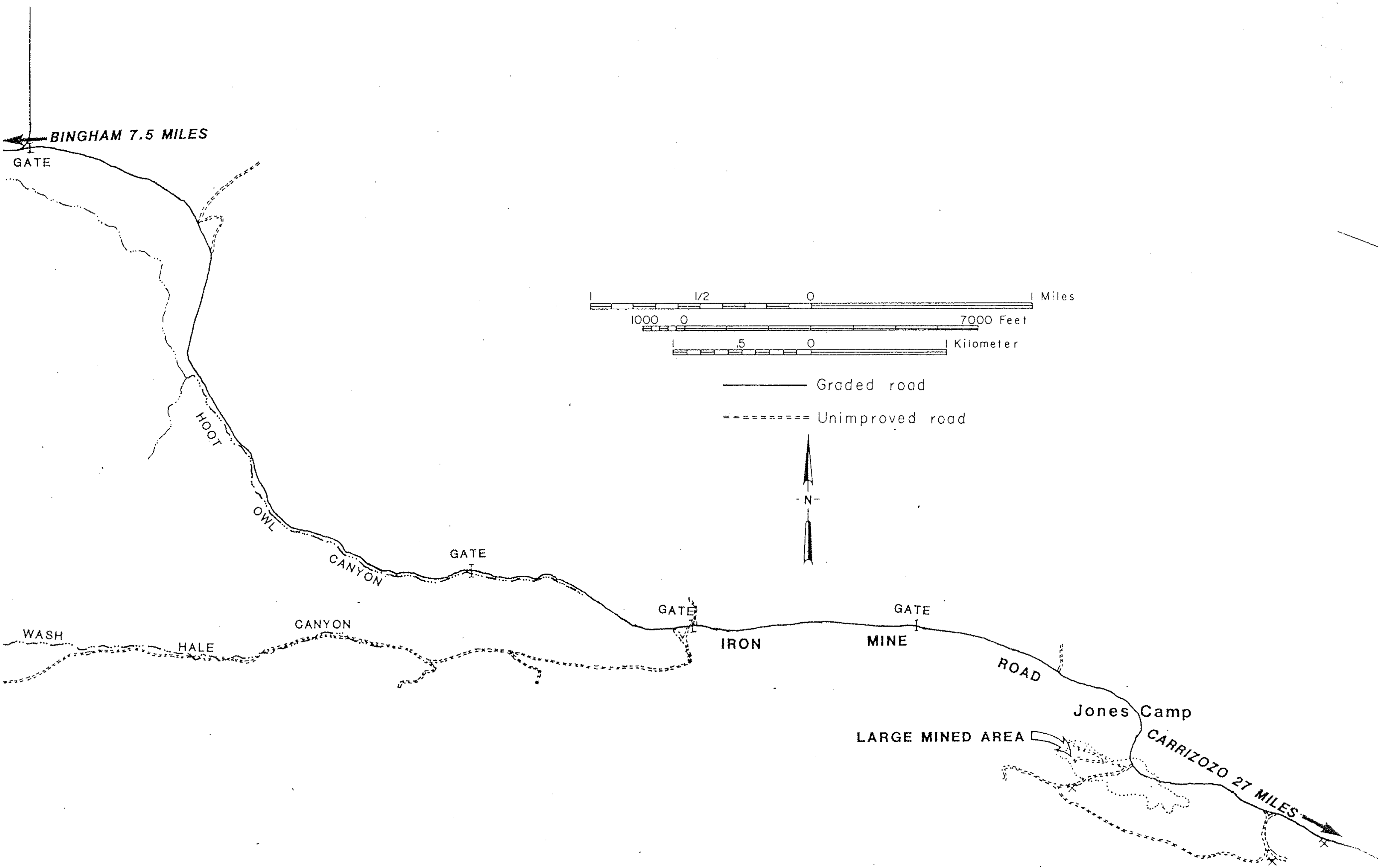


Figure 2. Location map of Jones Camp mining district.

FIELD TRIP GUIDE TO THE

LEMITAR MOUNTAINS, NEW MEXICO

With round-trip road log from Socorro
to prospects in the Lemitar Mountains

Total mileage: 25 miles

Field Trip to the Northeastern Lemitar Mountains

Barite-fluorite-galena veins are found associated with carbonatites in the northeastern Lemitar Mountains. Oxidation of these veins has produced attractive "micros" of wulfenite and hemimorphite. The abstract of a paper on the area given at the 4th New Mexico Mineral Symposium follows the road log. In addition to the maps (Figs. 1 and 2, pp. 6 and 7) the map listed below is helpful.

This is a short trip which, during the dry season, requires only two-wheel drive.

SUGGESTED MAP

Map Name	Scale	Available from
Lemitar 7½′ quadrangle	1:24,000	New Mexico Bureau of Mines and Mineral Resources

Round-trip road log from Socorro to prospects
in the Lemitar Mountains

0.00	Entrance to I-25 at the north end of Socorro. Stay left, take I-25 northbound. 0.25
0.25	Cross over I-25. 0.45
0.70	Merge left on to I-25. 1.10
1.80	Bridge. 0.20
2.00	Escondida exit. Continue north on I-25. 2.90
4.90	Sign, "Lemitar, Polvadera 1 mile." Prepare to exit at Lemitar. 0.40
5.30	Bridge. 0.60
5.90	Lemitar exit. Turn right off I-25. 0.10
6.00	Stop sign. Turn left and pass under I-25. 0.10
6.10	Cattle guard. Turn right just past cattle guard onto frontage road on the west side of I-25. 0.10
6.20	Cattle guard. Gutierrez Brothers Chili is on the left. 0.35
6.55	Pavement ends. Cal-West Metals is on the left, the Lemitar Mountains form the skyline beyond. 1.90
8.45	Road on right leads to Polvadera. Continue north on the frontage road. 0.10
8.55	Cattle guard. Polvadera Mountain is on the left. 0.15
8.70	Cattle guard. PREPARE TO TURN LEFT on the next road. 0.10
8.80	Turn left. Head west on dirt road. 0.25
9.05	Power line road. Pass under power line and continue west. 0.20
9.25	Gate. Continue through gate. LEAVE GATE AS YOU FIND IT (it's usually open). 0.45
9.70	Cross draw. 0.70
10.40	Cross draw. 0.60

11.00 Gate. PREPARE TO TURN LEFT.

11.00+ Turn left on VERY DIM ROAD, just beyond steel cattle tank. (Look for the road between a wooden post on the west and the cattle tank on the east.) 0.10

11.10 Turn right on dim road. A pile of rocks marks this turn-off (as of 11/83). 0.15

11.25 Enter draw. 0.10

11.35 Prospects on left. The road follows a sandy wash for the next 0.85 miles. The road is generally passable in two-wheel drive vehicles (as of 11/83), but may be washed out after rain storms. 0.85

12.20 Cuts on left ahead are in wulfenite-bearing veins. PARK BELOW (east) CUTS!!! The road is very rough. (Four Wheelers - continue AT YOUR OWN RISK!) The small open-pit mine ahead was opened for barite in the early 1980's. Little production resulted. The veins contain barite, fluorite, galena, quartz, sphalerite, chalcopyrite, pyrite, and calcite with wulfenite, hemimorphite, cerussite, anglesite, and malachite as products of oxidation. The wulfenite crystals range in size up to 5mm, but the large ones are commonly thin and break easily. Some attractive "micros" can be found with relative ease.

Retrace route to Socorro. 12.20

24.40 Socorro

MINERALOGY OF THE CARBONATES AND BARITE-FLUORITE-SULFIDE VEINS IN THE EASTERN LEMITAR MOUNTAINS, SOCORRO COUNTY, NEW MEXICO

Virginia T. McLemore and Robert M. North
New Mexico Bureau of Mines and Mineral Resources
Socorro, New Mexico 87801

Paleozoic carbonatites (minimum age 449 m.y. ± 16 m.y.) intrude the Precambrian rocks exposed in the eastern Lemitar Mountains, Socorro County. Carbonatites are unique carbonate-rich rocks of apparent magmatic origin and are characterized by a distinct but variable mineralogy, chemistry, and associated alteration. The Lemitar carbonatites occur as dikes, stockworks, and veins and display textures, mineralogy, chemistry, and wallrock alteration typical of carbonatite complexes. They contain greater than a 50% carbonate minerals and varying amounts of apatite, magnetite, pyroxenes, and other accessory minerals. Despite variation in texture of the Lemitar carbonatites, they can be grouped on the basis on mineralogy and mode of emplacement as: 1) silicocarbonatite dikes; 2) sovite (greater than 90% calcite), ravhaugite (greater than 90% dolomite), and carbonatite veins; 3) ankerite-dolomite carbonatite dikes; and 4) stockwork carbonatites.

Barite-fluorite-sulfide veins occur in the vicinity of the carbonatite dikes and occur locally with some carbonatites. The primary mineralization of the veins is barite, fluorite, galena, sphalerite, quartz, and small amounts of chalcopyrite, pyrite, and calcite. Many of the veins contain silver. Subsequent alteration has produced wulfenite, hemimorphite, cerussite, hematite, and a small amount of malachite, chrysocolla, and anglesite. Barite-fluorite-galena mineralization is common in central New Mexico and is considered to be Tertiary. This mineralization is probably formed by the expulsion of basinal brines along fractures related to the Rio Grande rift. However, it is possible that some of the barite mineralization in the Lemitar Mountains is related to the carbonatites and is Paleozoic.

The presence of carbonatites in the Lemitar Mountains may also have tectonic significance. Carbonatites are commonly associated with continental rifts or lineaments, and the carbonatites in Socorro County support current theories that rifting occurred as early as Precambrian of Paleozoic. Other carbonatites and alkalic rocks in New Mexico and Colorado are similar in composition and age to the Lemitar carbonatites; this also supports the theory of Precambrian or early Paleozoic rifting.

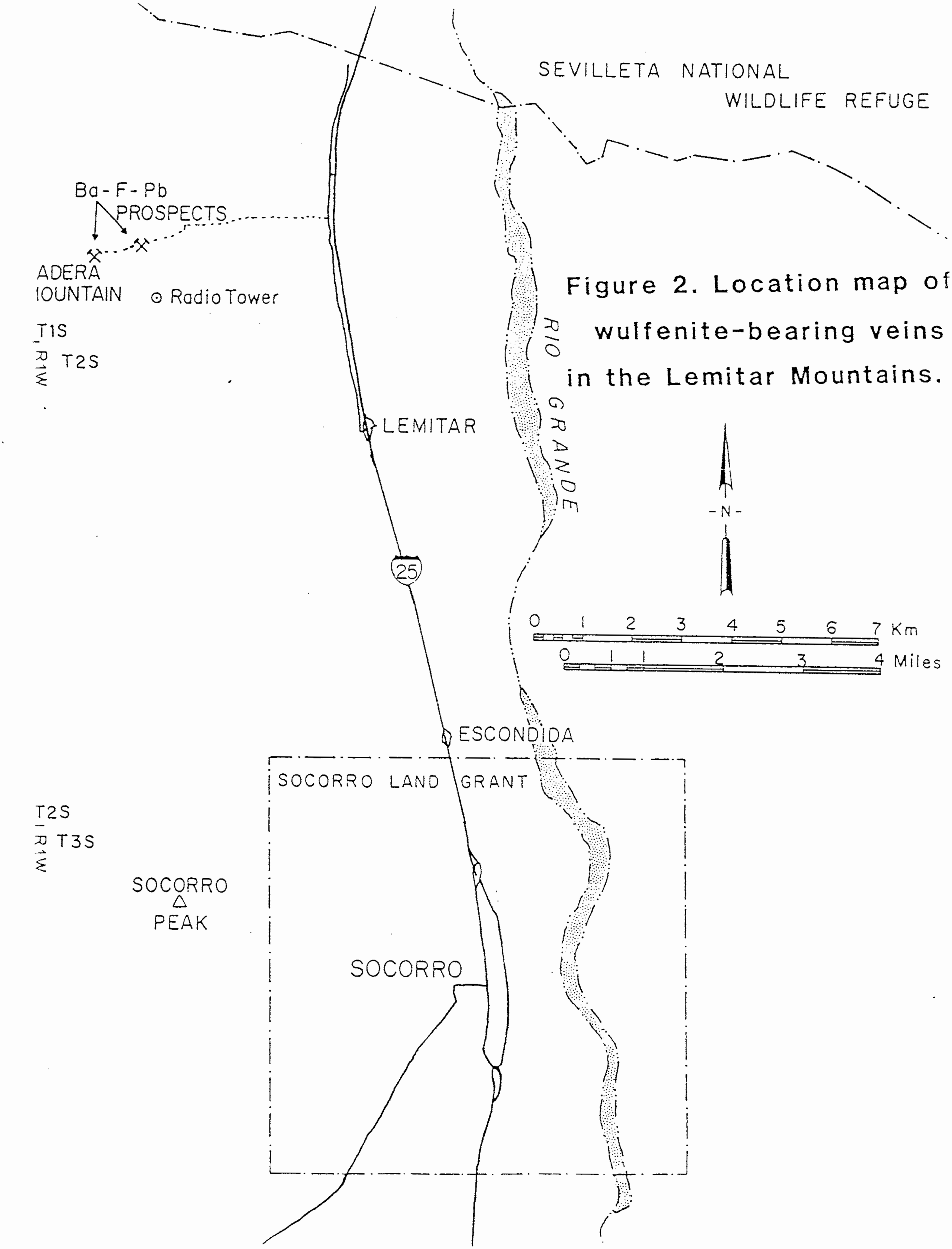
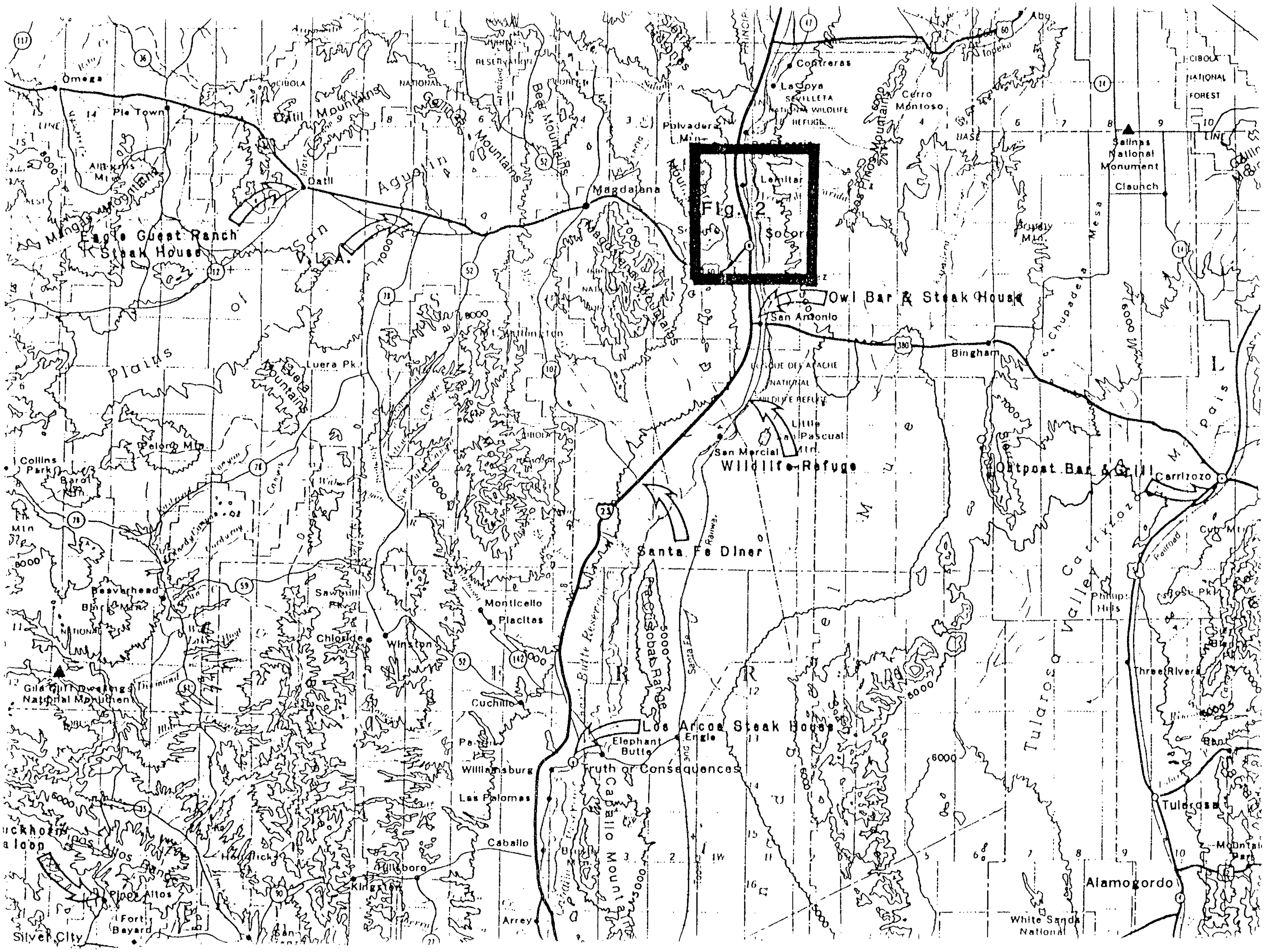


Figure 2. Location map of wulfenite-bearing veins in the Lemitar Mountains.



Omega
Pie Town
Datil
Datil Mountains
Magdalena
Eagle Guest Ranch
Steak House
San Agustin
V.L.A.
Plains of
Bear Mountains
Gallinas Mountains
Polvadera
Lemitar
Fig. 2
Socorro
Contreras
La Joya
Sevilleta National Wildlife Refuge
Cerro Montoso
Los Pinos Mountains
Salinas National Monument
Claunch
Owl Bar & Steak House
San Antonio
Bingham
Bosque del Apache National Wildlife Refuge
Little San Pascual Mtn.
San Marcial
Wildlife Refuge
Outpost Bar & Grill
Carrizozo
Chupadera Mesa
Luera Pk.
Collins Park
Pelona Mtn
Beaverhead
Santa Fe Diner
Monticello
Placitas
Chloride
Winston
Cuchillo
Los Arcos Steak House
Elephant Butte
Engle
Truth or Consequences
Williamsburg
Las Palomas
Caballo
Caballo Mountains
Hillsboro
Kingston
Arrey
Pinos Altos
Fort Bayard
Silver City
Gila Cliff Dwellings National Monument
Tularosa Valley
Tularosa
Three Rivers
Alamogordo
White Sands National
Philips Hills
Santa Fe Railway
Fra Cristobal Range

MINERAL-COLLECTING GUIDE TO HANSONBURG MINING DISTRICT, SOCORRO COUNTY, NEW MEXICO

M. L. Wilson and J. Reiche

with round-trip roadlogs from Socorro
to the Blanchard, Mex-Tex, and Royal Flush claims

Total mileage: 102 (includes supplementary roadlog)

MINERAL-COLLECTING GUIDE TO HANSONBURG MINING DISTRICT, SOCORRO COUNTY, NEW MEXICO

M. L. WILSON AND J. REICHE

The Hansonburg mining district lies at the northern end of the Sierra Oscura near Bingham in northeastern Socorro County. Three groups of mines have produced world-class specimens of a variety of mineral species including some of the finest linarite ever discovered. Many specimens can still be found on old mine dumps and in outcrops. Collecting is permitted on a fee basis.

The Hansonburg district has been intermittently active since the 1880's. Low ore grades and lack of water necessary for processing the ores have hampered development although interest in the deposits has continued to the present time. Two types of deposits are present in the area. The first consists of sandstone-hosted copper deposits in the hills west of the Sierra Oscura. Although of interest mineralogically, these deposits usually do not yield collectible mineral specimens and are not included in this guide. The second type, of much more interest to collectors, consists of carbonate-hosted deposits exposed in the fault scarps and ridges of the Sierra Oscura.

Major ore minerals of the carbonate-hosted deposits are barite, fluorite, and argentiferous galena. Other collectible minerals include aurichalcite, azurite, brochantite, calcite, caledonite, cerussite, chalcopyrite, chrysocolla, gypsum, hemimorphite, jarosite, linarite, malachite, murdochite, plattnerite, pyrite, quartz, rosasite, smithsonite, spangolite, sphalerite, and wulfenite, among others. (For a complete listing of all species from the district, see the article by Taggart, Rosenzweig, and Foord in the Mineralogical Record, 1989, v. 20, no. 1, pp. 31-46.) Most minerals occur in vugs or vein fillings in the limestone.

COLLECTING CONDITIONS IN THE HANSONBURG DISTRICT CAN BE EXTREME. Temperatures often exceed 100°F in the summer and may drop below freezing in the winter. Flash floods can occur during summer thunderstorms and roads may become muddy when wet. Lightning can be dangerous on the ridges. Rattlesnakes are present in the area and may be encountered in holes or beneath rocks, particularly in the morning and evening hours. Common sense should dictate collecting activities, and equipment such as hats and hard hats, gloves, and safety glasses should be considered essential, as should plenty of drinking water.

The Blanchard, Mex-Tex, and Royal Flush claims are fee collecting sites. collectors should stop at the rock shop in Bingham (505-423-3235) to receive collecting tips, sign a liability waiver, and pay a $5.00-per-person collecting fee. Specimens may be collected from the mine dumps or, with care, from outcrops. When collecting near the cliff faces, watch out for loose or falling rocks. The underground workings are extremely hazardous so UNDERGROUND COLLECTING IS **STRICTLY PROHIBITED**. Please remember that mineral collecting at these sites is a courtesy extended to the public by the claim holders, and violation of the underground collecting prohibition could result in revoking these privileges and closing the claims to collectors.

SUGGESTED VEHICLES

A 2-wheel-drive vehicle is adequate to reach the Blanchard claims, but a 4-wheel-drive vehicle is recommended for the Mex-Tex and Royal Flush Trip.

SUGGESTED MAPS

Name	Scale	Available from
Garden Spring Canyon 7.5′ quadrangle	1:24,000	NMBM&MR
Wrye Peak 7.5′ quadrangle	1:24,000	NMBM&MR
Wrye Peak NW 7.5′ quadrangle	1:24,000	NMBM&MR
Wrye Peak SW 7.5′ quadrangle	1:24,000	NMBM&MR

These maps were used to make Figs. 2a,b. Please regard the topography in the figures as a guide to the landscape. The roadlogs are more accurate about trails and tracks.

Round-trip roadlog from Socorro
to the Blanchard, Mex-Tex, and Royal Flush claims
in the Hansonburg mining district, Socorro County, New Mexico

0.0 Intersection of College and California Streets. Pizza Hut southeast of the intersection and Furr's grocery store northwest. **Proceed north** on California Street. **0.5**

0.5 **Turn right** onto entrance ramp to southbound I-25 (Interstate exit 150). **2.3**

2.8 Pass exit 147. South Socorro, Socorro Municipal Airport, U.P.S. facilities, and Luis Lopez manganese district. **0.8**

3.6 Crossing Arroyo de la Matanza. Dicaperl's Socorro perlite mine visible in Socorro Mountains on right. **2.9**

6.5 Pass under NM-1. **4.5**

11.0 **Turn off** onto exit 139 to San Antonio and **continue east** on US 380. **0.5**

11.5 Dry stream bed (Walnut Creek). **0.1**

11.6 Dirt road on right to Nogal Canyon. **0.4**

12.0 San Antonio Official Scenic Historical Marker on right. **0.4**

12.4 Junction US 380 with NM-1. Owl Bar and Cafe on left, Bosque de Apache National Wildlife Refuge approximately 8 miles to right. **Continue east** on US 380 for 28.5 miles to Bingham. **0.2**

12.6 Cross Atchison, Topeka and Santa Fe Railroad tracks. **0.4**

13.0 Cross over San Antonio riverside drainage ditches. **0.2**

13.2 Cross bridge over Rio Grande. **0.6**

13.8 Dirt road on right to San Pedro. **0.4**

14.2 Paved road on left to Bosquecito. **0.9**

15.1 Cross bridge over dry stream bed. **0.4**

15.5 Railroad grade of the Carthage branch of the Santa Fe Railroad on right. This line was abandoned in the 1890's and briefly rebuilt in the early 1900's as the New Mexico Midland Line serving the Lime quarry visible at 18.9 (below) and coal deposits at Tokay. **0.7**

16.2 Cross bridge over dry stream bed. **1.3**

17.5 Cross bridge over dry stream bed. **0.8**

18.3 Gilmore coal mine at Tokay visible ahead on right. **0.4**

18.7 Cross bridge over dry stream bed. **0.2**

18.9 Quarries on left where limestone was mined for lime kilns (visible at edge of stream bed below quarries). Dirt road on right leading to Fite ranch, Gilmore coal mine, and ghost towns of Carthage and Tokay. This was an important coal-mining area from the 1880's to 1925. The district remained intermittently active until 1968. **1.4**

20.3 Coal waste piles on right. **0.6**

20.9 Dirt road on right to Carthage cemetery and ghost towns of Carthage and Tokay. **0.1**

21.0 Carthage, Tokay-Fraley Official Scenic Marker on right. **0.6**

21.6 Bridge over dry stream bed. Old Hart (Baca) cola mine visible on right. **0.1**

21.7 Dirt road on right to Hart (Baca) and other coal mines, Fite ranch, etc. Socorro County Road A137 on left leads to Cañon Agua Buena. **1.0**

22.7 Road descends into the valley of the Jornada del Muerto (Journey of the Dead Man). Peaks of the Cerro de la Campana, composed of volcanic pyroclastic units, are visible on the right. The Sierra Oscura are visible in the distance ahead to the right. White Sands Missile Range lies on the right. **0.4**

23.1 Socorro County Road A129 on left. **1.0**

24.1 Trinity Site Official Scenic Marker on right. Junction with NM 525 to Stallion Range Center and Trinity Site. **0.6**

24.7 Site of relocated Carthage general store on right. **3.0**

27.7 Dirt roads on right and left. Muncy ranch headquarters on right. **1.0**

28.7 Dirt road on right to Gallegos ranch. **4.3**

33.0 Flowing-sand area for next 6 miles. DO NOT PULL OFF except in designated areas as the sandy shoulder is often soft and deep and vehicles may easily become stuck. **1.0**

34.0 Roadside parking area on right with picnic table and shade but no water or lavatories. **0.4**

34.4 Roadside parking area on left with picnic table and shade but no water or lavatories. **0.4**

34.8 Roadside parking area on right with picnic table and shade but no water or lavatories. **4.2**

39.0 Gravel pull-off on right. **0.6**

39.6 Roadside parking area on left with picnic table and shade but no water or lavatories. **1.3**

40.9 Town of Bingham with old gas station and general store on left. **0.4**

41.3 Rock shop to right. **Stop here** for detailed collecting information; sign liability waiver and pay $5.00/person collecting fee. **Proceed east.** **0.1**

41.4 **Turn south** at Bingham Post Office, cross cattle guard in road east of Post Office. Bingham well on left beyond fence. **0.3**

41.7 Dry stream bed. **0.2**

41.9 Dirt track on left to Pinto Tank. Continue straight. **0.6**

42.5 Stand pipe on left. **0.3**

42.8 Pass under power line. **0.1**

42.9 **Take road left.** Dirt road on right leads to Sullivan well, Bulldog tank, and Hansonburg copper prospects. **0.3**

43.2 Dirt road on left. Continue straight. **0.2**

43.4 Pass under power line. **0.5**

43.9 Grove of creosote (greasewood) next 0.6 miles. **0.2**

44.1 Dirt road on left. Continue straight. **0.1**

44.2 Dirt road on right. Continue straight. **0.2**

44.4 Stone corrals and ruins on right and left. **0.2**

44.6 Earthen dam and Julian tanks on left. Road to left leads to the Royal Flush and Mex-Tex mines (see Supplementary Log 1). Continue straight. Tall blonde salt grass next 0.4 miles. **0.1**

44.7 Two older tracks on left to the Royal Flush and Mex-Tex mines. Continue straight. **0.05**

44.75 Cross Julian wash. **BEWARE OF FLASH FLOODS IN THIS AREA. 0.25**

45.0 Cattle guard, dirt track on left leads to water tank in 0.05 miles. Continue straight. **0.2**

45.2 U.S. General Land Office bench mark (small cairn with upright pipe) on right. **0.4**

45.6 Dirt track on left. Continue straight. **0.1**

45.7 Pass under power line. **0.15**

45.85 **Take left fork** to collecting areas. Right fork leads to White Sands Missile Range. **DO NOT TRESPASS ON MISSILE RANGE PROPERTY. 0.75**

46.6 Pass under power line. Sign "west boundary Blanchard property." Dirt track on right leads to Hansonburg Canyon. Continue straight. **0.1**

46.7 Old no-trespassing sign on left. Old Western General Resources Hansonburg mill ahead. Dirt track on right leads to ruins of older mill and Blanchard homestead. Above ruins is old Blanchard glory hole. **Turn left.** Concrete slab on left. This is a good parking and camping site. **0.2**

46.9 Dirt road on right leads to lower approach to old Blanchard glory hole. Small parking area 0.2 miles in. Proceed on foot from there. **DO NOT ENTER** underground workings in this area as they are extremely dangerous. **0.2**

47.1 Locked gate. Small excavation on left. Small turn-around area on right. Continue on foot past the gate. **DO NOT BLOCK** the road and gate with parked vehicles. **0.2**

47.3 Continue up main road to left. Road on right leads to old Blanchard glory hole in approximately 600 feet. **DO NOT ENTER** underground workings in this area as they are extremely dangerous. **0.4**

47.7 Road on right leads to the Sunshine #1 in approximately 500 feet. Confine collecting activities to **SURFACE ONLY**. Continue straight to more collecting sites. **0.15**

47.85 Parking area on right with corrugated steel core shack. Sunshine #2, 3, and 4 are to the left. Confine collecting activities to **SURFACE ONLY**. Continue straight to more collecting sites. **0.05**

47.9 Gravel track on left leads to Sunshine #4 in approximately 335 feet. Confine collecting activities to **SURFACE ONLY**. Continue straight to more collecting sites. **0.1**

48.0 Dirt track on left leading to Clarence Barrett workings. Continue straight to more collecting sites. **0.1**

48.1 Open area on left leads to Sunshine #6 workings (buried). Do not attempt to collect underground in this area as the old workings are extremely dangerous. Continue straight to more collecting sites. **0.1**

48.2 End of line. Small workings to left and ahead. Fence protects northern boundary of White Sands Missile Range. **DO NOT CROSS THIS FENCE.**

96.4 Retrace route to return to Socorro.

SUPPLEMENTARY LOG 1 TO ROYAL FLUSH AND MEX-TEX MINES

0.0 **Turn east** at road intersection at Julian tanks (44.6 on main roadlog). **0.2**

0.2 Old dirt track joins from right. Continue straight. **0.35**

0.55 Old building on left. Go through gate ahead and <u>close gate behind you.</u> **0.05**

0.6 **Take right** fork in road. **0.02**

0.62 Dirt track to left leads to Royal Flush workings. This track requires a vehicle with high clearance. Corrugated steel shack to left in 0.4 miles. Road ends in 0.2 miles at Royal Flush. Confine collecting activities to **SURFACE ONLY.**

Continue straight to reach the Mex-Tex mine. **0.08**

0.7 Cross Julian wash. **BEWARE OF FLASH FLOODS IN THIS AREA. 0.1**

0.8 Dirt tracks ahead: 1 to right, 2 to left. These tracks require a vehicle with high clearance. Right track dead ends. Far left track leads to the Desert Rose mine (also known as the Mountain Canyon mine and the Downey stope) in 0.4 miles. Confine collecting activities to **SURFACE ONLY**.

Take near left (center) track to Mex-Tex mine. **0.1**

0.9 Old sign on right. **0.5**

1.4 Small excavation on left. Continue straight. **0.1**

1.5 Footpath to right leads to Ora mine in approximately 1,700 feet and Caliche prospect in approximately 3,200 feet. **This path will not safely support vehicles.** Confine collecting activities to **SURFACE ONLY**. **0.3**

1.8 Old track joins from left. Continue straight. **0.3**

2.1 Trail to right leads to lower Mex-Tex workings in approximately 650 feet. Confine collecting activities to **SURFACE ONLY**. **0.1**

2.2 **Take right fork** to the upper Mex-Tex workings. Left fork leads to northern boundary of White Sands Missile Range in 0.4 miles. This is a dead-end road with no turn-around space. **0.1**

2.3 Mex-Tex mine. Confine collecting activities to **SURFACE ONLY as underground workings are extremely dangerous. 0.1**

2.4 Dead end and parking area for Mex-Tex workings.

4.8 Retrace route to intersection at Julian tanks.

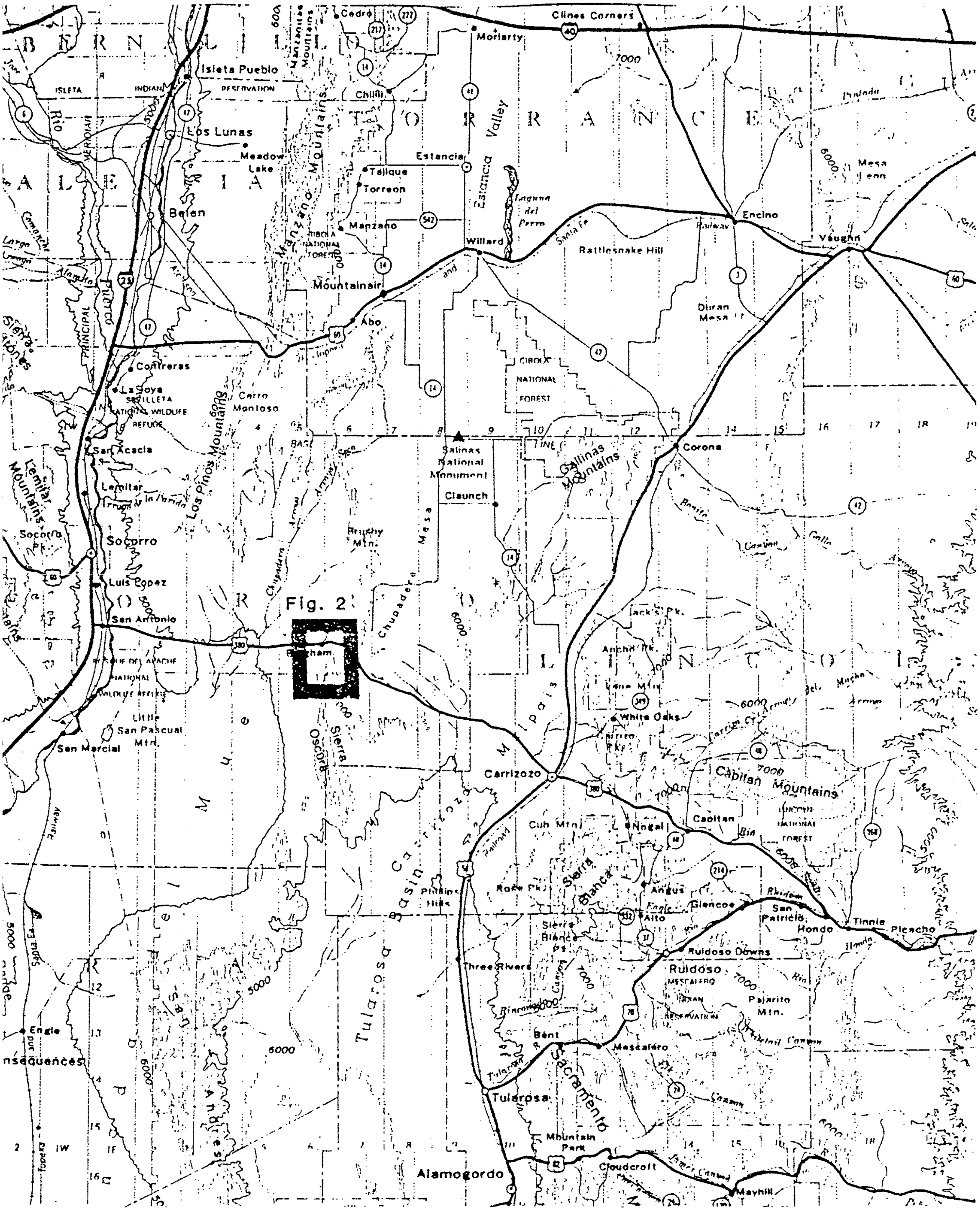
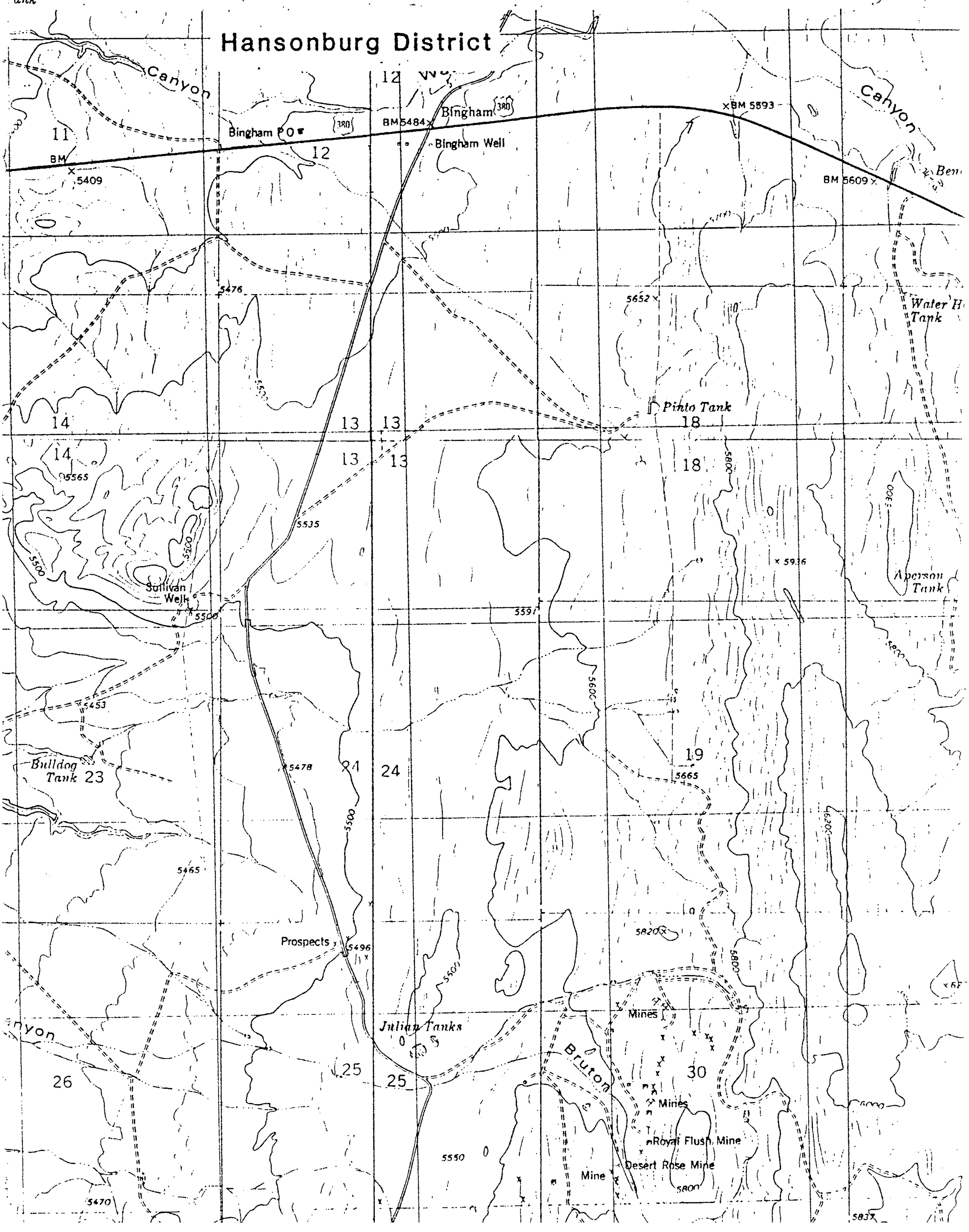
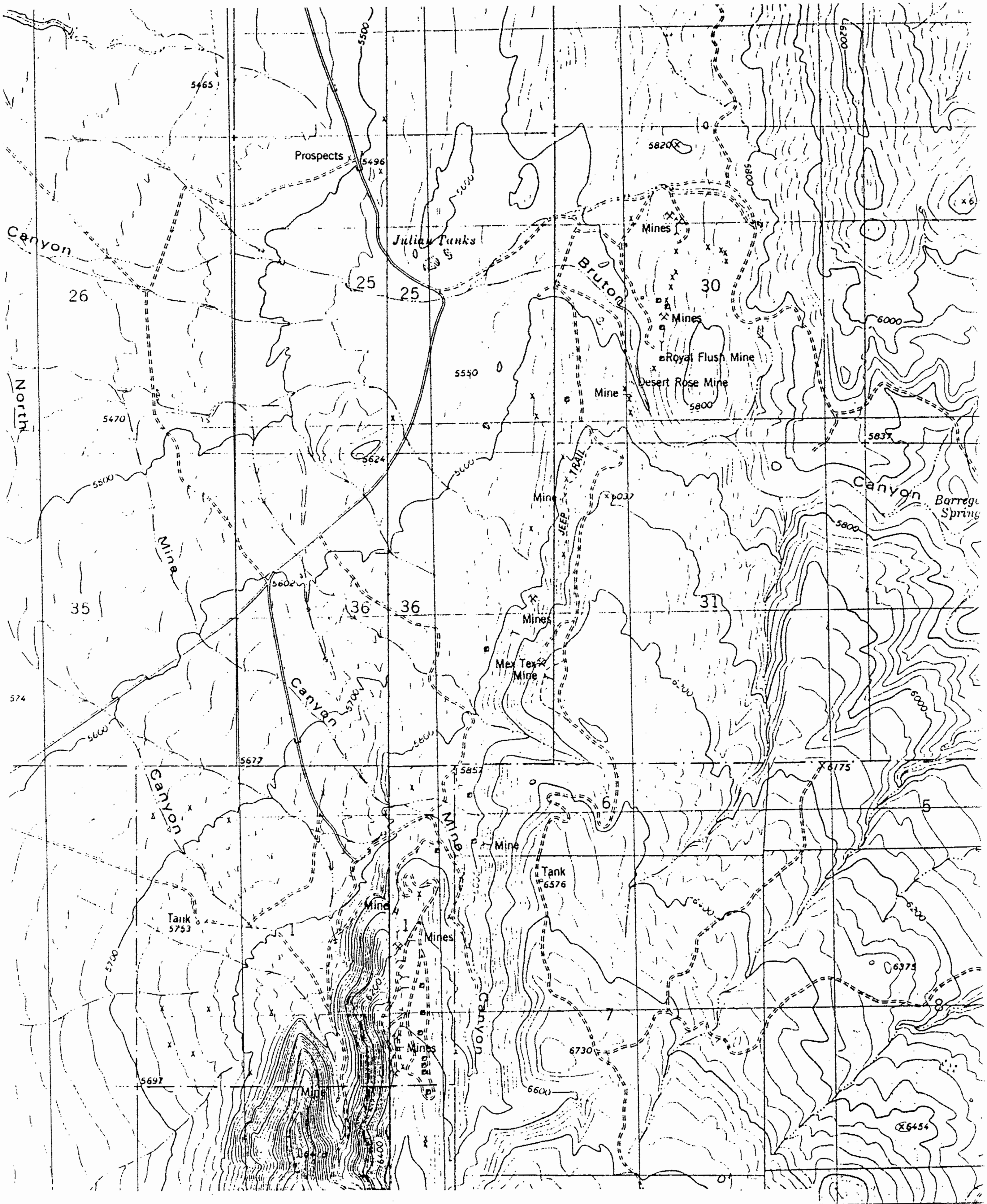


Figure 1: Location map of the Hansonburg District

Figure 2a: Topographic map of the northern portion of the Hansonburg District





igure 2b: Topographic map of the southern portion of the Hansonburg District

MINERAL-COLLECTING GUIDE TO THE LUIS LOPEZ MINING DISTRICT, NEW MEXICO

V. T. McLemore, R. M. Chamberlin, and R. M. North

With round-trip road log from Socorro to prospects in the Luis Lopez mining district

Total mileage: 18 miles

Manganese minerals, especially a velvet-like mass known as "rat's hair" psilomelane, are found in this mining district near Socorro.

The short trip requires only two-wheel-drive vehicles unless there has been a recent heavy rain.

An abstract from the third New Mexico Minerals Symposium and the reprint of an article from the Guidebook to the Socorro area are included after the road log. "Where to look" is usually given in clock-face terminology: 12:00 is straight ahead, 9:00 is due left, and 3:00 is due right. In addition to the maps (Figs. 1 and 2, at the end of the guide) the maps listed below may be helpful.

SUGGESTED MAP

Name	Scale	Available from
Luis Lopez 7½' quadrangle	1:24,000	New Mexico Bureau of Mines and Mineral Resources

Road Log from Socorro to prospects in the Luis Lopez District

0.0 Junction of US 60 and Spring St. **Continue straight onto US 60. 0.4**

0.4 Railroad crossing, Grefco spur of the AT&SF. Ascend hill onto remnant of mid-Pleistocene fan surface. Manganese stockpiles on the right. **0.4**

0.8 Socorro High School on left. **0.4**

1.2 Socorro General Hospital on left. **0.9**

2.1 Entrance on right to Grefco perlite operation. Commercial perlites are hydrated volcanic glass, heated to produce a lightweight, nearly inert product. Perlite is used as a lightweight aggregate in construction products (wallboard) and as filter aids. New Mexico is the leading producer of perlite in the U.S. The Grefco deposit was the principle domestic source of perlite during the infant years of the industry. This deposit is the youngest of a series of siliceous lava domes (the Socorro Peak Rhyolite) guided to the surface by the deep plumbing of the Morenci lineament (transverse shear zone) and north-trending faults of the rift. This high-silica (78% SiO_2) rhyolite dome is about 7.4 m.y. old, as determined by K-Ar dating of a whole-rock sample. **0.1**

2.2 Bridge across the concrete ditch that diverts water from Socorro Canyon southward into Arroyo de la Matanza, milepost 136. Light-colored sands of the ancestral Rio Grande are exposed at eastern base of ridge. These beds form the oldest part of the fluvial facies of the Sierra Ladrones Formation and intertongue westward with piedmont-slope alluvium. Pale-red, ledge-forming outcrops of fanglomerate are piedmont facies of the same formation that were shed from the eastern Magdalena Range. This Plio-Pleistocene basin-fill unit is the youngest formation of the Santa Fe Group in the Socorro-Albuquerque Basin area. **0.3**

2.5 Milepost 136. Stockpiles of manganese concentrates on left. Spur at 3:00 of lower Pliocene olivine basalt; flat-topped basalt overlies Sierra Ladrones Formation and is distinctly offset by range-bounding fault zone. **0.4**

2.9 Piedmont fault scarp at apex of Pleistocene alluvial fan at mouth of Socorro Canyon. Recurrent movement on this range-bounding fault offsets the late Pleistocene terrace (foreground) approximately 10 ft, middle Pleistocene gravels (9:00) approximately 100 ft, and the Pliocene basalt flow (3:00) at least 200 ft. **0.4**

3.3 Foundations of old Great Lakes Carbon perlite mill on Pleistocene arroyo terrace on the right. Waste dumps of perlite fines (white) at 3:00. **1.1**

4.4 Milepost 134, bend in road. At 1:30, hummocky landslide blocks of basalt are derived from Black Mountain (mesa on skyline). An unusually large exposure of red Popotosa claystones may be seen in the north wall of Socorro Canyon at 2:00. Incompetent Popotosa claystones underlie all of the landslide terrane below Black Mountain; this is the same basalt flow that rests on the ancestral Rio Grande deposits at the mountain front. **1.2**

5.6 Crossing east-bounding fault of Chupadera range. Roadcut in deposits of rhyolitic tuff faulted against underlying porphyritic andesite lavas, all part of the Oligocene Luis Lopez Formation. The formation is the collective name for the heterogeneous moat fill of the Socorro cauldron. The white rhyolitic tuff has been zeolitically altered (clinoptilolite). **0.4**

6.0 Roadcut on left of variegated red and green gypsiferous mudstone and clay and interbedded thin basaltic flow or sill (?). **0.4**

6.4 Milepost 132. Crossing fault contact between Popotosa on east and volcanic moat deposits (Luis Lopez Formation) on west. **0.1**

6.5 Bridge over Box Canyon, milepost 131. Entering large roadcut in Luis Lopez Formation dikes and tuffs, which are overlain by red debris-flow deposits and fanglomerates of lower Popotosa Formation. **0.3**

6.8 **Turn left** onto dirt road. (CAUTION! Vehicles frequently come downhill on US 60 at high speeds.) Dirt road is on lower member of Popotosa Formation. **0.2**

7.0 Cattleguard. Andesitic lava forms ridge on left. **0.2**

7.2 Discontinuous playa beds of Popotosa in roadcuts on right. **0.1**

7.3 Road junction. **Turn left** into arroyo leading north into Box Canyon. Ascend hill. **0.9**

8.2 Pit on left exposing minor manganese mineralization. **0.1**

8.3 Road junction. **Take right** fork uphill. South Canyon Tuff forms top of hill at 9:00. Most hills from 11:00-12:00 in middle skyline are "sea" of intracaldera Hells Mesa Tuff on resurgent dome of Socorro cauldron. **0.3**

8.6 Rhyolite intrusion forms south wall of canyon at 10:00-11:00. Notch of Black Canyon at 9:00 formed by thick andesite lava flow strongly tilted to east. The Gloryana mine is on top of the hill at 3:00. **0.1**

8.7 **STOP 1.** Turn around and park. Dumps of Gloryana mine are visible on top of the hill to the west.

The Gloryana mine lies on the eastern edge of the 28.8 m.y. old Sawmill Canyon cauldron where it cuts across the resurgent dome of the Socorro cauldron. Jasperoidal silica veinlets in the Gloryana pit are hosted by the 24.4 m.y. old South Canyon Tuff. Conformable to unconformable relationships below the South Canyon Tuff locally define the margin of the older Sawmill Canyon caldera. In the Luis Lopez district, jasperoidal silica is commonly associated with Oligocene caldera structures and early rift faults of late Oligocene to early Miocene age. In comparison, manganese and manganiferous calcite mineralization is commonly associated with late-stage rift structures and locally cuts late Miocene rhyolite lavas. These relationships suggest that the crosscutting veinlets in the Gloryana pit represent two long-lived hydrothermal systems: the older one active from about 32 to 20 m.y. ago, the younger one active from about 12 to 7 m.y. ago.

Mineralization at the Gloryana occurs in the South Canyon Tuff. Below, to the east, are pits and dumps of the Grand Canyon mine where manganese mineralization is in basaltic andesite lavas. To the south, shafts of the Tower mine are cut into the Lemitar Tuff. "Rat's hair" psilomelane, general formula [$(Ba,K,Mn,Pb,Co)Mn_5O_{10}\bullet H_2O$], a velvet-like manganese mineral, occurs along fractures and occasionally can be found by breaking open large boulders. Other manganese minerals include pyrolusite (MnO_2), cryptomelane (KMn_8O_{16}), hollandite ($BaMn_8O_{16}$), among other manganese oxides. Black and white calcite and rhodochrosite are also found. "Rat's hair" psilomelane may be found in pockets along manganese veinlets that are not associated with calcite. For more information see North and McLemore (see attached article). Good luck! **8.7**

17.4 Retrace route back to Socorro.

MANGANESE OXIDES (PSILOMELANE) FROM SOCORRO COUNTY, NEW MEXICO

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The exact nature of the banded, massive to radiating-fibrous black manganese oxides from the Luis Lopez district, Socorro County, has long been and continues to be a mineralogical riddle. The material has been described variously as psilomelane, "pseudo-psilomelane," pyrolusite, pseudomorphs of psilomelane after pyrolusite, hollandite, coronadite, and intergrowths of hollandite + romanechite. The difficulties arise because the material is mineralogically complex and does not fall into simple mineral categories. Much of it is poorly crystalline and gives diffuse x-ray diffraction patterns. Its chemical composition is variable, with the proportions of large metal cations (Ba, Pb, K, Sr), the water content, and the proportions of manganese in different oxidation states all varying between ideal end members such as hollandite, $Ba(Mn^{+4}, Mn^{+2})_8O_{16}$; coronadite, $Pb(Mn^{+4}, Mn^{+2})_8O_{16}$; cryptomelane, $K(Mn^{+4}, Mn^{+2})_8O_{16}$; and romanechite, $BaMn^{+2}Mn^{+4}{}_8O_{16}(OH)_4$. Banded, fibrous material from the vicinity of the Tower and Nancy mines at the head of Black Canyon, Luis Lopez 7½ min topographic quadrangle, gives x-ray powder diffraction patterns that generally match hollandite. Electron microprobe analysis shows this material to be chemically zoned; individual layers range from nearly pure barium-manganese oxide (containing 5-15 mole percent cryptomelane but no lead) to material containing as much as 20 weight percent PbO, close to coronadite in composition. Turner and Buseck (1979, Science, v. 203, p. 456-458), using high-resolution transmission electron microscopy, have shown that individual crystal fibers from the Rattlesnake mine in the Luis Lopez district are composed of a mixture of submicroscopic regions, with single unit-cell layers of romanechite randomly distributed within a crystal lattice that is dominantly hollandite. This variably constituted mineral only marginally satisfies the criteria of crystal structure, fixed chemical composition, and homogeneity that are used to define a specific mineral species. The material could be called hollandite because that is its dominant composition and crystal structure. Alternatively, it might be considered a mineraloid rather than a particular mineral species, and the old general term, psilomelane, may be the best name to use after all.

FIGURE 1. Index map of the Socorro area.

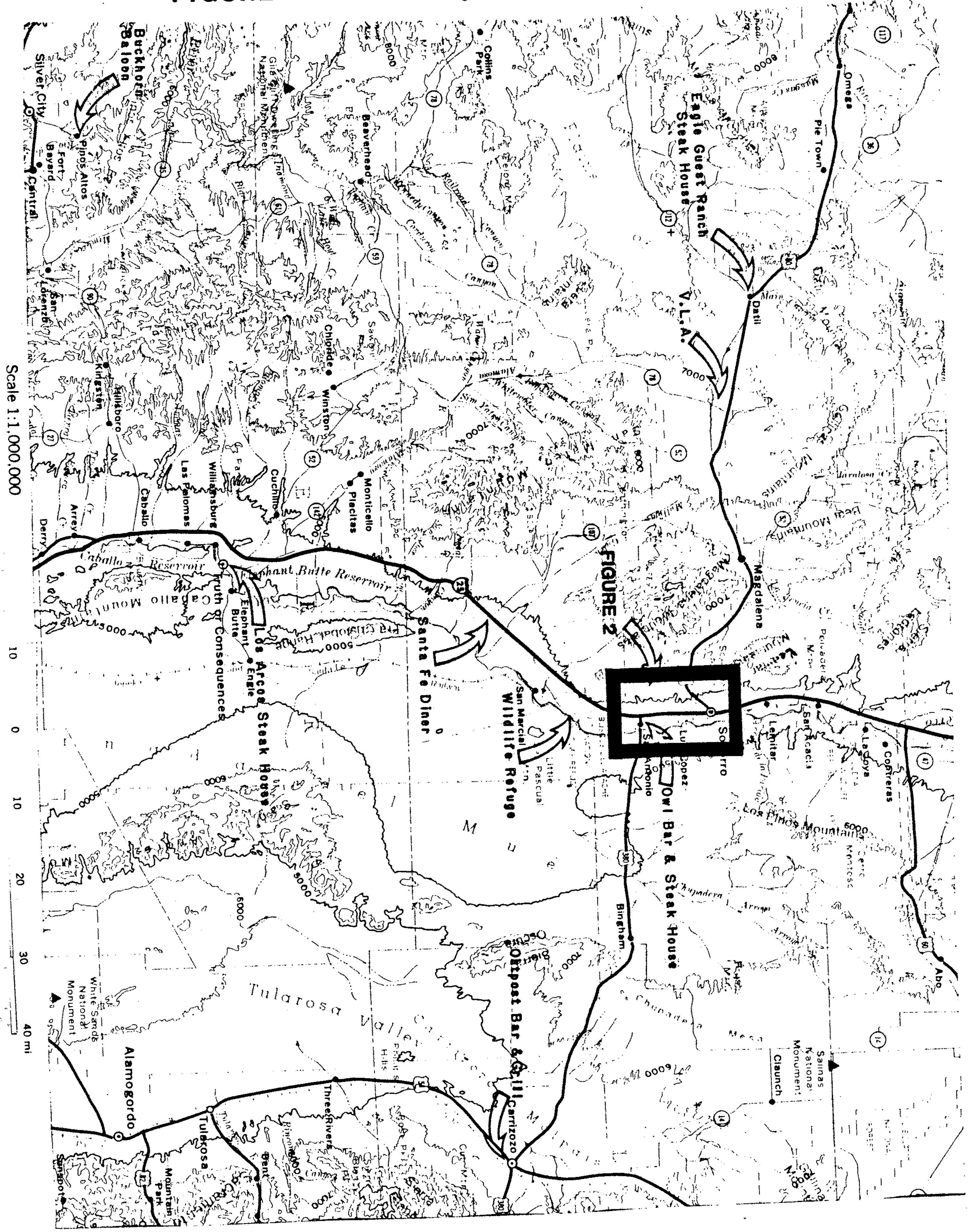
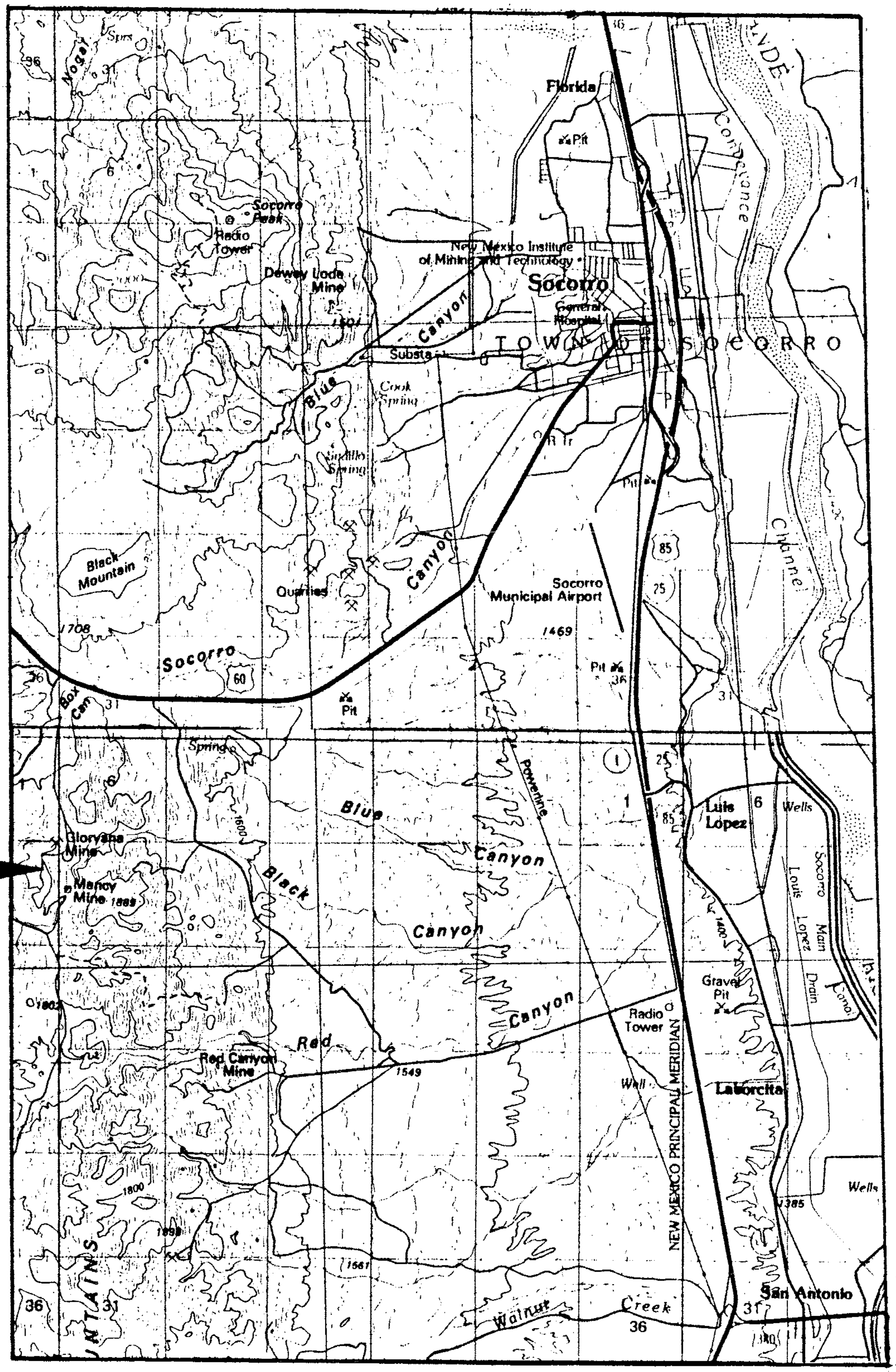


FIGURE 2. Location map of the Luis Lopez district.

Luis Lopez
district



Scale

MILES 1 0 1 2 3 4

MINERAL LOCALITY LEAFLET 1

New Mexico Bureau of Mines and Mineral Resources

HARDING PEGMATITE
Dixon, New Mexico

The Harding pegmatite was discovered about 1910 and was worked sporadically depending upon market prices. During World War II the mine was actively worked and produced strategic minerals, including microlite, columbite-tantalite, beryl, spodumene, and lepidolite, with the encouragement of the War Production Board. The mine is unique as the only substantial producer of microlite in the world. From 1950 through 1955, 752 tons of beryl were produced, amounting to more than 20 percent of the total United States production during that period. The mine is not operating at present.

The mine dumps are excellent collecting spots for all mineral collectors. Large in Pennsylvania and owner of the property, offered to donate the Harding mine to the University of New Mexico in order that it be preserved as one of New Mexico's unusual natural assets. Because the mine property included both patented and unpatented claims the transfer of title required the transfer of federal lands to state lands. This literally required an "Act of Congress" (Senate Bill 1403), which was signed by President Carter as part of Public Law 95-550 on October 30, 1978.

A permission-release form from the University of New Mexico Geology Department in Albuquerque is required before entering the Harding mine property. These forms may be obtained from the Chairman, Department of Geology, University of New Mexico, Albuquerque, New Mexico 87131, or from Lebeo's General Store in Dixon.

Collect only loose rock and never hammer on the quarry walls near the mine entrances. Please take only what you can use for your own collection or a maximum weight limit of 10 lbs. The caretaker lives in the area and visits the mine frequently. Persons who violate these rules will be prosecuted.

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LOCALITY LEAFLET 2

FOSSIL LOCALITIES

New Mexico has many areas where fossils are abundant, but, to date, there is no single publication that describes these areas or shows their locations on maps. Some general locations that are suitable for fossil collecting are listed below. These are selected on the basis of convenient access and ease of collection.

1. Along <u>NM Highways 44 and 536</u> to the crest (and on the crest) of the Sandia Mountains, near Albuquerque, Pennsylvanian limestones contain brachiopods, bryozoans, and crinoid stems.

2. Tijeras Canyon, near Albuquerque, about 5 miles south of the junction with Interstate 40, <u>NM Highway 10</u> passes through a series of road cuts in Pennsylvanian limestone that contains brachiopods, bryozoans, and trilobites.

3. Jemez Springs, on <u>NM Highway 4</u> about 20 miles north of San Ysidro. Hills and stream behind ruined mission, (Jemez State Monument) yield a good selection of Pennsylvanian fossils.

4. On <u>US Highway 380</u> between San Antonio and Carrizozo. At Carthage, 8 to 10 miles east of San Antonio, Cretaceous rocks contain oysters, some ammoniods, and other forms. In several small roadcuts 3 to 5 miles farther eastward, limestones of the Permian Yeso Formation contain abundant small scaphopods. Farther eastward, on the east edge of the lava flow near Carrizozo, Cretaceous shales contain <u>Inoceramus</u>, a clam.

5. On <u>US Highway 380-70</u> between Hondo and Roswell, some Permian fossils can

be found in the roadcuts.

6. NM Highway 83 (US 82), eastward from US Highway 54 north of Alamogordo, passes through a thick section of highly fossiliferous Pennsylvanian rocks that yielded some silicified fossils. Just east of Cloudcroft, the Permian San Andres Limestone exposed at roadside in several places is fossiliferous but massive, and specimens are difficult to collect.

7. NM Highway 90, about 14 miles east of Santa Rita (30 miles west of Kingston), passes through roadcuts in fossiliferous Devonian shales. Fields farther to the east, before the road descends, steep hills have many weathered, silicified Silurian brachiopods.

8. US Highway 64, from Taos to Eagle Nest passes through many roadcuts, mainly in shaly Pennsylvanian rocks, that yield good fossils.

9. Along US Highway 85, south of Springer, shark teeth can be found in the Cretaceous Greenhorn Limestone.

10. Along US Highway 60, west of Scholle, Pennsylvanian limestones contain brachiopods and bryozoans.

11. Along NM Highway 63, north of Pecos in the Pecos River Canyon, Pennsylvanian limestone brachiopods, and bryozoans.