Preliminary report on the geology and mineral-resource potential of Torrance County, New Mexico

by

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ABSTRACT

A preliminary mineral-resource potential assessment of Torrance County involves analyses of available published and unpublished geologic, geochemical, geophysical, and economic data and a brief field reconnaissance study. Mineral-resource potential is an assessment of the favorability that a commodity will occur in economic concentrations in a given area; a classification of high, moderate, low, very low, or unknown is assigned. A high mineral-resource potential exists in areas where the geologic and economic data indicate an excellent probability that economic mineral deposits occur there. Moderate or low mineral-resource potential exists in areas where the data indicate a lesser probability that economic mineral deposits occur. A classification of very low mineral-resource potential is reserved for areas where sufficient information indicates that an area is unfavorable for economic deposits. A classification of unknown mineral-resource potential is reserved for areas where necessary geologic and economic data are inadequate to otherwise classify an area and any other classification (high, moderate, low, or very low) would be misleading.

Construction materials, such as sand, gravel, limestone, dolomite, clay, and dimension stone, have a high mineral-resource potential in certain parts of Torrance County. High-calcium limestones and adobe, halite, carbon dioxide, and petroleum have moderate mineral-resource potentials in specific areas of

Torrance County. The potential for gold and silver deposits, with or without associated copper, in Precambrian greenstones in the northern Manzano Mountains also is moderate. Low to moderate mineral-resource potential is assigned to stratabound copper deposits in the Scholle district, to copper and lead (with or without associated gold and silver deposits) in Precambrian metamorphic rocks, to gypsum deposits, and to petroleum reserves in certain portions of Torrance County. The mineral-resource potential for coal, talc, sulfur, and Precambrian stratabound iron-ore is very low in Torrance County. Several areas in Precambrian terranes in Torrance County have significant potential for base and precious metal deposits and uranium mineralization; however, insufficient information exists to assess adequately some of these areas. Therefore, these mineral-resource potentials are classified as unknown until additional information becomes available.

Additional geologic mapping and geochemical sampling are required in the Precambrian terranes in Torrance County, in north-central Torrance County, in limestone terranes, along the Glorieta Sandstone Member, near active claims, and in other areas delineated by the HSSR data as having geochemical anomalies. Mapping of the structural geology, isopach facies maps, and structure-contour maps should be completed in order to delineate favorable areas for oil, gas, and carbon dioxide accumulations. Drilling is required in areas where the Precambrian rocks are near the surface in order to evaluate them for base and precious metal deposits.

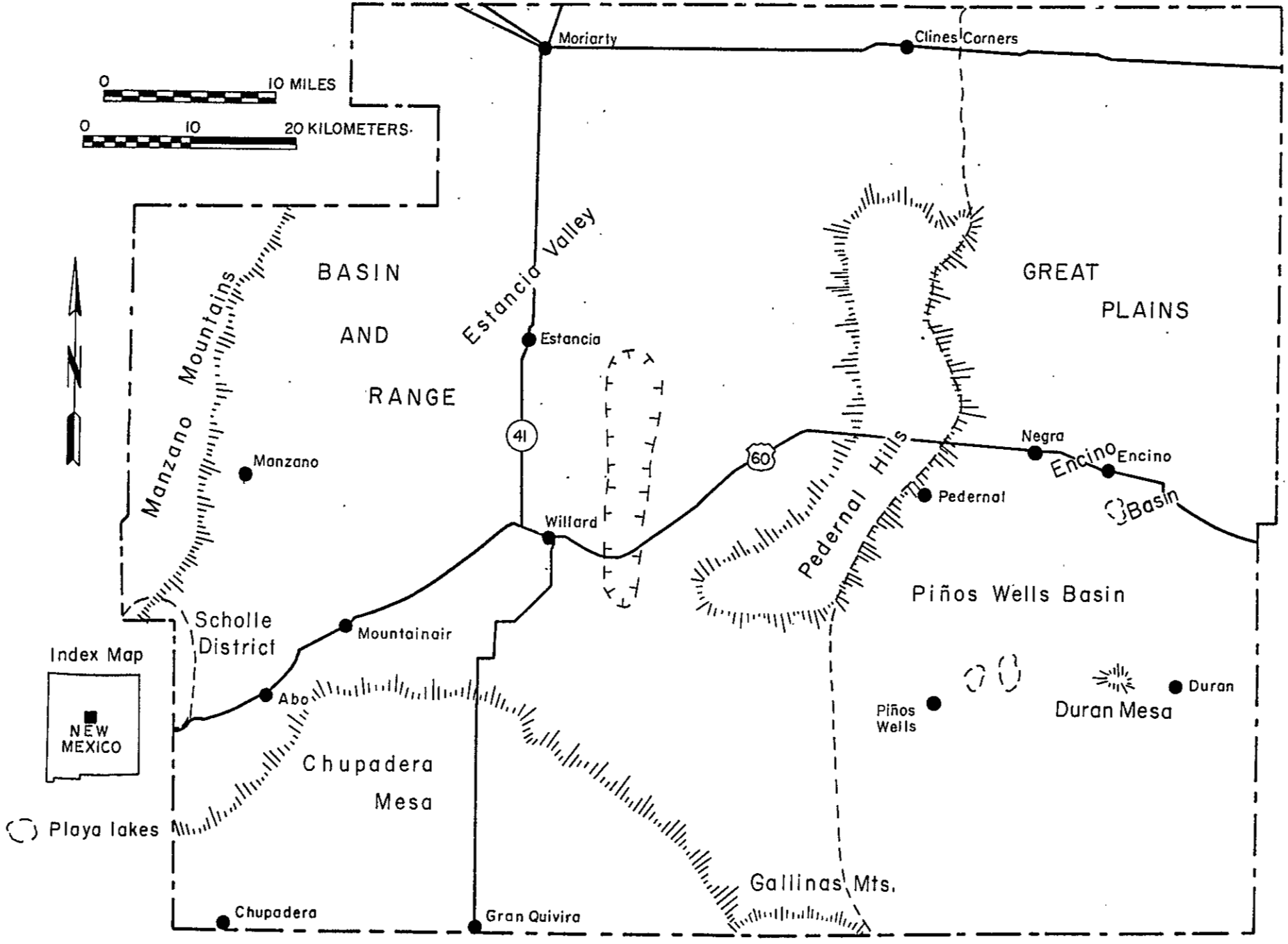
INTRODUCTION

Purpose and scope

The Federal Land Policy and Management Act of 1976 (FLPMA) charges the U.S. Bureau of Land Management (BLM) with responsibility for preparing a mineral-resource inventory and assessment of mineral-resource potential for all of the public lands they manage. These studies are essential to land-use planning and management, and they are required prior to BLM actions such as disposal, withdrawal, exchange, or conveyance of land and wilderness designations. In order to meet this statutory requirement, the BLM contracted the New Mexico Bureau of Mines and Mineral Resources (NMBM&MR) to prepare a preliminary mineral-resource inventory and assessment for the Torrance County (Fig. 1) portion of the Rio Puerco resource area. NMBM&MR staff were already actively involved with compilations and geologic studies of various commodities on all lands within New Mexico, so the requirements of both agencies were satisfied. A future open-file report by NMBM&MR staff will discuss the mineral-resource potential in Sandoval, Bernalillo, and adjacent parts of McKinley, Cibola, and Santa Fe Counties in the Rio Puerco resource area.

This preliminary mineral-resource inventory and assessment is based on analysis of available published and unpublished geologic, geochemical, geophysical, and economic data and a brief (10-day) field reconnaissance study. A more rigorous and com-

Figure 1—Physiographic provinces and geographic features in Torrance County



plete analysis of all available information and additional field work could expand the preliminary conclusions of this report.

Methods of investigation and sources of information

This study involved a complex process of integration and analysis of various data sets that included: (1) published and unpublished reports; (2) CRIB (Computerized Resource Information Bank of the U.S. Geological Survey, prepared in part by NMBM&MR); (3) MILS (Mineral Industry Location Survey of the U.S. Bureau of Mines, prepared by NMBM&MR); (4) DMEA (Defense Minerals Exploration Administration) reports; (5) NURE (National Uranium Resource Evaluation of the U.S. Department of Energy), HSSR (Hydrogeochemical Stream-Sediment Reconnaissance), and ARMS (Aerial Radiometric and Magnetic Survey) data; and (6) various file data from numerous state and federal agencies (NMBM&MR, State Inspector of Mines, State Highway Department, BLM, U.S. Bureau of Mines, U.S. Department of Energy). From these data, known mineral occurrences (Appendix 1) were located and mineral deposit types were identified. Geologic, mineral occurrence, geochemical (element distribution and geochemical anomaly maps), and geophysical (radiometric, magnetic, and gravity) maps were compiled and correlated to delineate areas of potential mineralization. Finally, the mineral-resource potential of an area was assessed.

Ten days were spent in the field examining the iron deposits at the Jones Camp (Socorro County), Chupadera, and Garner mines (Torrance County), the uranium and thorium occurrences at Lobo and Pedernal Hills, the Gabaldon copper mine, a dike swarm in

southwestern Torrance County, barite deposits at El Cuervo Butte (Santa Fe County), the Milagros gold mine (Valencia County), and various vein deposits in the Manzano Mountains. Samples were collected and chemical analyses were included in this report. The Scholle district was previously studied by the author (McLemore, 1982, 1983a) and those results were used to determine its' mineral-resource potential.

This report is organized into a text, four appendices, and numerous figures and tables. Known mineral occurrences, prospects, deposits, and mines, including materials pits, are briefly described individually in Appendix 1 and also described generally by deposit type in the text. Appendix 2 is a tabulation of oil and gas tests. Appendix 3 contains statistical summaries of the HSSR geochemical data. Mineral and other commodity occurrences are plotted in Figure 10 and in six 1:100,000-scale maps as dictated by the BLM (Figs. 11-16). An index to 1:100,000 scale maps used in this report is shown in Figure 2. Mineral-resource potential of various commodities is discussed in the text and shown in Figures 17-22 and 26-31.

Numbering system

The numbering system used in this report is based on the township, range, and section land-grid system (Fig. 3) that is used by the New Mexico State Engineer for numbering water wells and springs. In this system, each occurrence or sample location has a unique location number consisting of four parts separated by periods (e.g., 3N.5E.24.441). The first part refers to the

Figure 2—Index to 1:100,000 scale topographic maps covering Torrance County

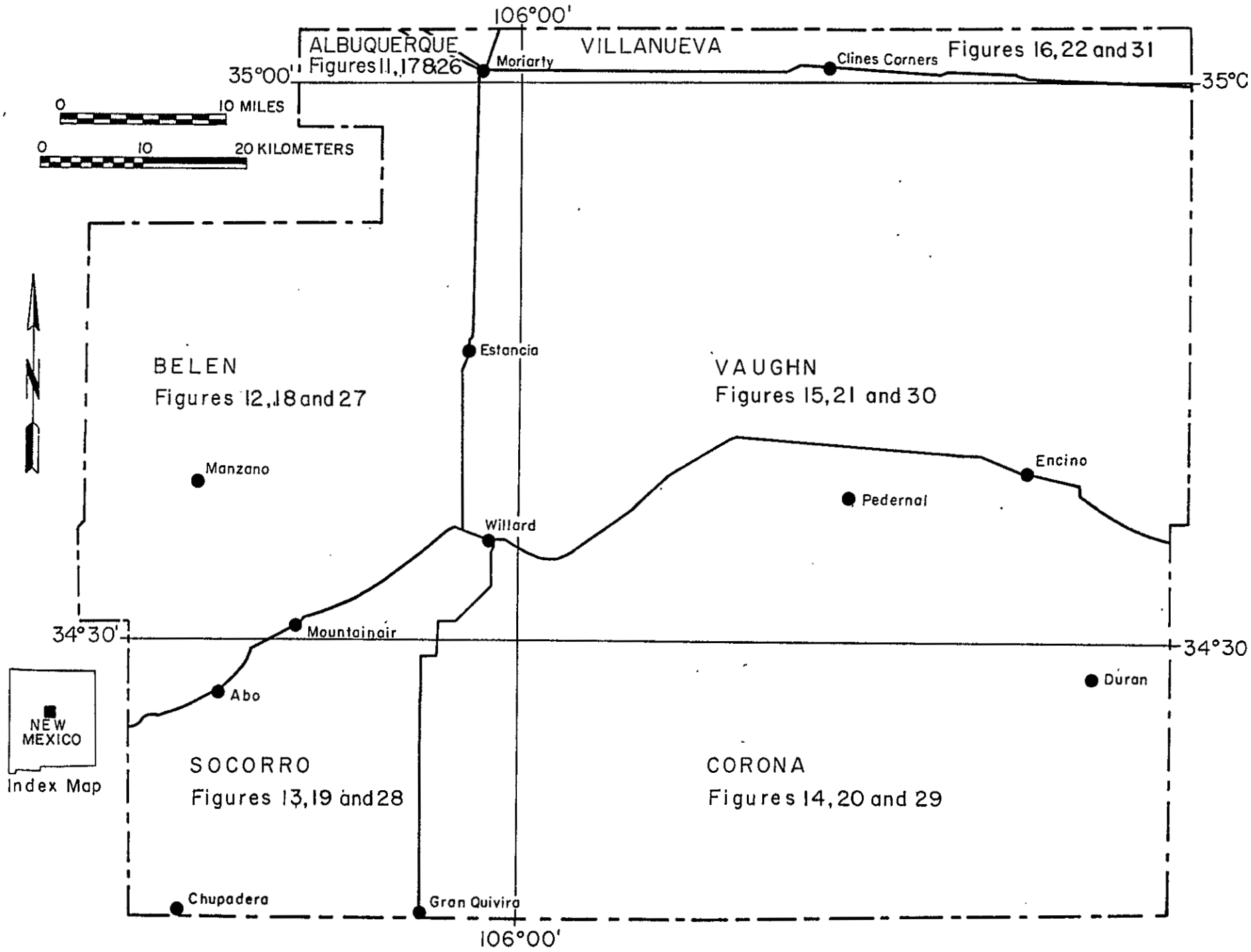
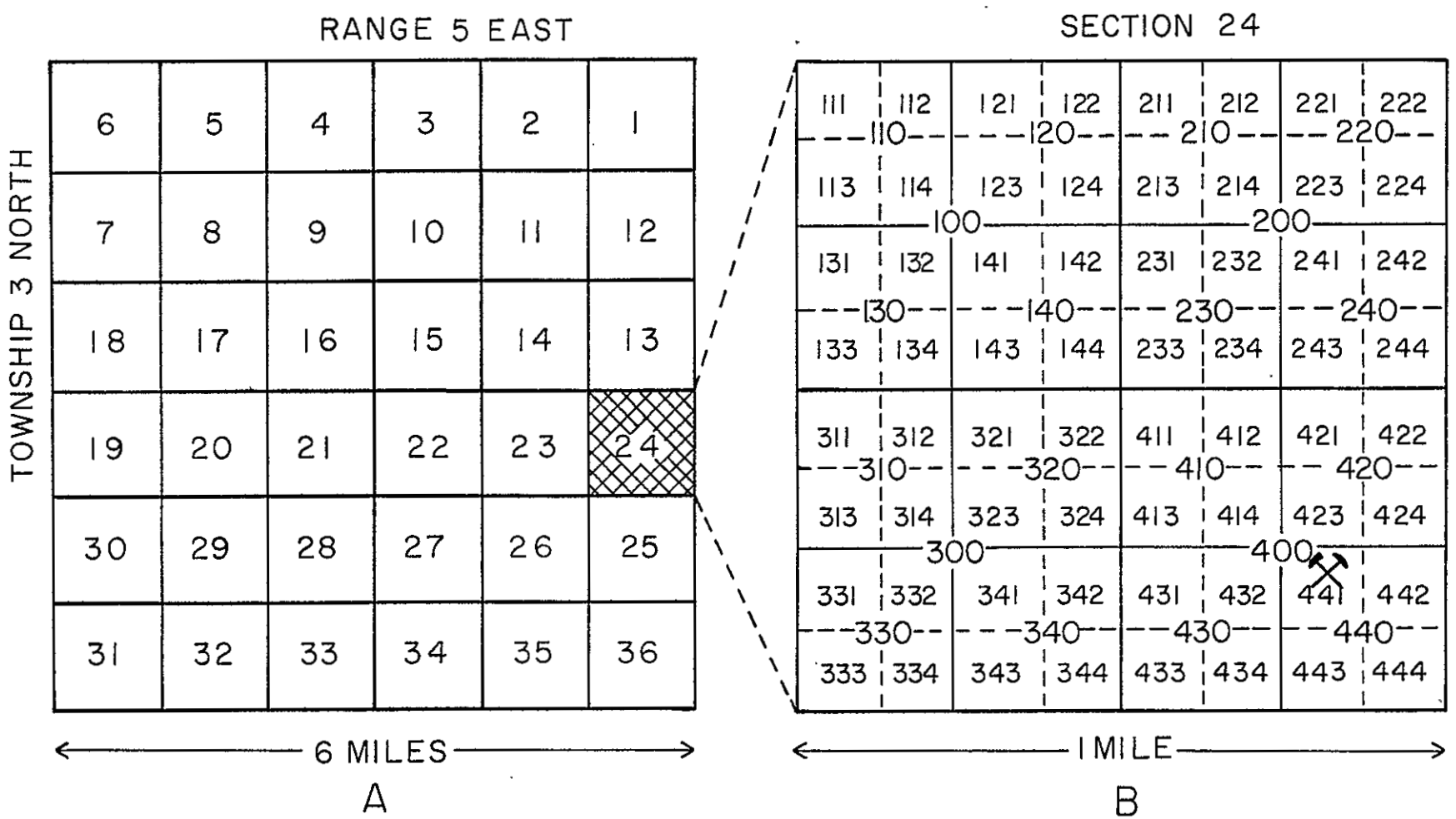


Figure 3— Numbering system used in this report.

A - Subdivision of a township into sections.

B - Subdivision of a section into quarter-quarter-quarter section blocks. Mine symbol indicates location of an occurrence numbered 3N.5E.24.441.



township, the second part to the range, and the third part to the section. The fourth part locates the occurrence to the nearest quarter-quarter-quarter section block, if possible, as indicated in Figure 3. An occurrence or sample number designated 3N.5E.24.441 is located in the NW 1/4 SE 1/4 SE 1/4 of section 24, T.3N, R.5E. Some occurrences are located only to the nearest section, quarter-section, or quarter-quarter section because the occurrence can not be located more accurately or it extends over the entire given area. In unsurveyed areas, the locations are approximated by projecting section lines.

Mineral-resource potential classification

The mineral-resource potential of an area is the favorability or probability that a commodity will occur in economic concentrations. The mineral-resource potential is not a measure of the quantities of the mineral resources, but of the potential occurrence of the commodities in substantial concentrations that can be produced under current or future economic conditions (Taylor and Steven, 1983). The evaluation of the mineral-resource potential is based on analogous geologic situations of promising or favorable geologic environments or settings that contain known economic deposits. Such subjective appraisals or judgements depend not only on available information concerning the favorable area, but also on the current knowledge and understanding of known economic deposits. Mineral-resource potential is not a firm assessment, but a relative evaluation based on available information at a specific time.

Mineral-resource potential depends on a number of factors

that include: (1) location, size, and grade of the mineral deposits; (2) past production; (3) depth of overburden to favorable host rock; (4) locations of mineral belts or trends; (5) specific geologic phenomena known to be associated with mineral deposits (silicic or alkalic igneous rocks, carbonatites, greenstones, or structural features); (6) reported exploration activity; (7) reported recent discoveries; and (8) geophysical and geochemical anomalies.

Classification of mineral-resource potential differs from the classification of mineral resources. Mineral resources are the quantities of economic resources and are classified according to availability of geologic data and economic feasibility as identified (demonstrated or inferred) or undiscovered (hypothetical or speculative) and economic or subeconomic (Krishna and others, 1983; U.S. Geological Survey, 1976a; 1980). The mineral-resource potential is a qualitative judgement of the probability for discovery of a certain type of commodity and is classified according to availability of data, geologic assurance, and relative probability of occurrence. Classification of mineral-resource potential varies from a simple, subjective scheme (Krason and others, 1982) to complex, quantitative, and statistical methods (Taylor and Steven, 1983; Singer and Mosier, 1981). A simple classification is used in this report and the mineral-resource potential is classified as high, moderate, low, very low, and unknown.

A high mineral-resource potential exists in areas of known mines or occurrences where the geologic, geochemical, or

geophysical data indicate an excellent probability that mineral deposits occur in economic concentrations. All active and producing properties fall into this class as well as identified deposits in known mining districts or in known areas of mineralization. Hypothetical deposits, such as reasonable extensions of known mining districts and identified deposits or partially known deposits within geologic trends or areas of mineralization, are classified as high mineral-resource potential when sufficient data exists that indicate a high probability of occurrence. Information, such as quantity, quality, grade, past and present production, depth to deposit, and reserves, is important although not always essential in evaluating an area suspected to have a high potential. Exploration is in progress or expected to occur within the next 10 years. This classification corresponds to the substantiated mineral-resource potential as described by the USGS (Brobst and Goudarzi; 1984).

A moderate mineral-resource potential exists in areas where geologic, geochemical, or geophysical data suggest a good possibility that undiscovered deposits occur in formations or geologic settings known to contain economic deposits elsewhere. Hypothetical deposits in known mining districts or mineralized areas are assigned a moderate potential if evidence for a high potential of economic deposits is inconclusive. This assessment can be revised when new information, new genetic models, or changes in economic conditions develop. This classification corresponds to the probable mineral-resource potential as described by the USGS (Brobst and Goudarzi; 1984).

Low mineral-resource potential exists in areas where

available data imply the occurrence of mineralization, but indicate a low favorability for the occurrence of an economic deposit. This includes speculative deposits in areas of geologic environments or settings not known to contain economic deposits, but which are similar to known economic deposits. Additional geologic data are required to better classify such areas.

Very low mineral-resource potential is reserved for areas where sufficient information indicates that an area is unfavorable for economic deposits. This evaluation may include areas with dispersed but uneconomic mineral occurrences as well as areas that have been depleted of their mineral resources. Use of the very low potential classification requires a high level of geologic assurance to support such an evaluation. Very low mineral-resource potential is assumed for potential deposits below depths at which the commodity can be extracted economically. These "economic" depths vary according to the commodity.

A classification of unknown mineral-resource potential is reserved for areas where necessary geologic, geochemical, and geophysical data are inadequate to otherwise classify an area. This assessment is assigned to areas where the degree of geologic assurance is low and any other classification (high, moderate, low, or very low) would be misleading. These areas should receive a high priority for additional study.

This classification scheme is highly subjective and dependent on the evaluator's knowledge and experience. Advances in technology, extraction methods, economic conditions, and

understanding of geologic processes that form economic deposits are likely to alter this assessment of mineral-resource potential. Political and public opinion could drastically alter the economic factors that influence mineral-resource potential classification of an area in a relatively short period of time. Therefore, assessments of mineral-resource potential must be periodically re-evaluated and updated.

In addition to evaluation of the mineral-resource potential, another classification system, potential for development, can be assessed. The potential for development is classified simply as high, moderate, or low for the purposes of this report. High potential for development indicates that the area is currently producing a commodity or economic conditions suggest that production of the deposit is economically feasible presently or in the near future. Moderate potential for development exists in areas where production of the deposit would occur if certain geologic or economic conditions became favorable. Low potential for development indicates only a slight possibility, if any, for production of the deposit. The potential for development classification is also a highly subjective judgement and is dependent on the evaluator's experience and understanding of geologic and economic conditions during a specific time period. But it does offer an evaluation of the economic feasibility of a deposit that the mineral-resource potential classification (potential for occurrence) neglects.

Physiography

The western two-thirds of Torrance County is within the

Basin and Range Province and the eastern third is within the Great Plains Province (Fig. 1). The Estancia Valley is the major basin in the Basin and Range portion of Torrance County and is bounded on the west by the Manzano Mountains and the on east by the Pedernal Hills. The Estancia Valley is a closed basin with numerous playa lakes in the center. The Pedernal Hills in central Torrance County and part of the Gallinas Mountains in south-central Torrance County form the eastern boundary of the Basin and Range Province in the Southwest. Chupadera Mesa extends into southwest Torrance County and consists of gently rolling hills and open valleys.

Eastward sloping uplands form most of the Great Plains Province in Torrance County. Several closed, shallow, and small basins, of which the Encino and Pinos Wells Basins are the largest, indent the surface. These basins are similar to the playa lakes in the Estancia Basin.

Previous Geologic Investigations

The geology of Torrance County is described as part of several regional geologic reports (V. C. Kelley, 1972; Bates and others, 1947), several reports concerning the geology of the Manzano Mountains (Cavin and others, 1982; Bauer, 1982; Myers, 1982), reports of the Pedernal Hills (Armstrong and Holcombe, 1982; Gonzalez and Woodward, 1972), reports of the Estancia Basin (Titus, 1969, 1973; Bachhuber, 1970, 1971, 1982; Meinzer, 1912), and one county ground-water report (R. E. Smith, 1957). These and additional reports will be cited where appropriate in the

Figure 4—Index to geologic mapping reports at scales 1:51,000 or larger

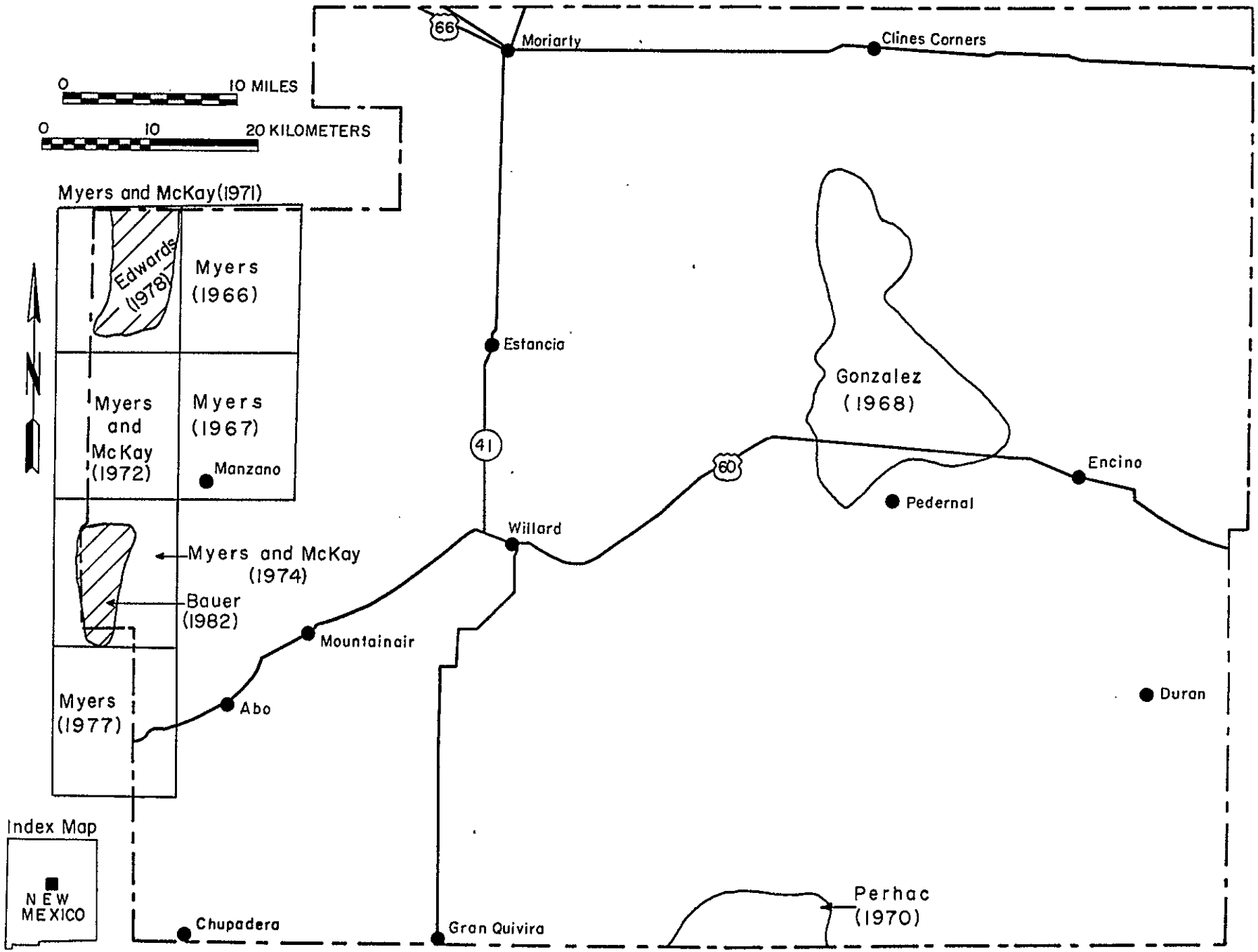
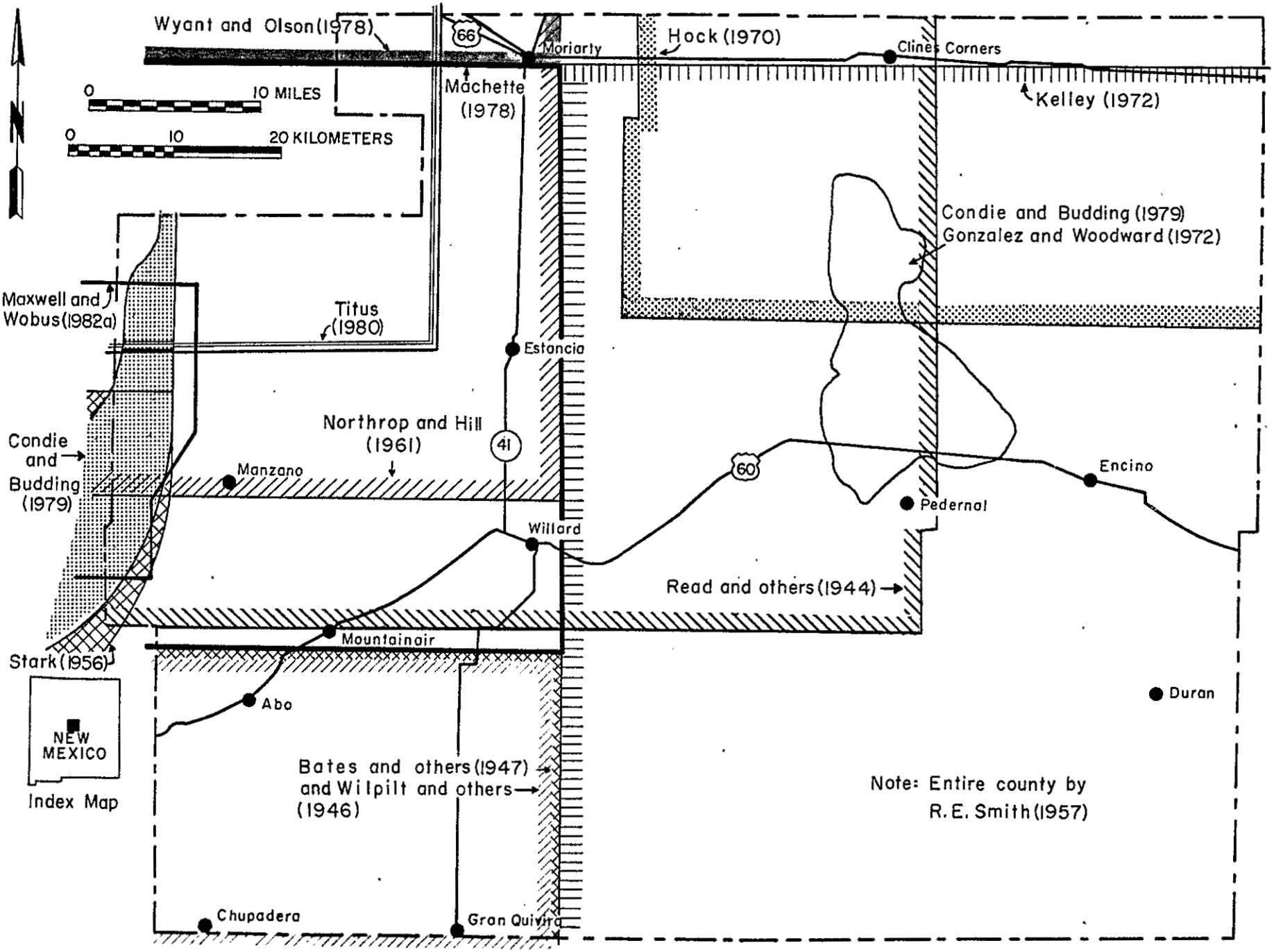


Figure 5—Index to geologic mapping reports at scales smaller than 1:51,000



text that follows. Detailed geologic maps are few and restricted to the western part of Torrance County (Fig. 4). However, additional smaller-scale maps include other portions of Torrance County (Fig. 5). Two state geologic maps (Dane and Bachman, 1965; New Mexico Geological Society and NMBM&MR, 1983) also include Torrance County.

Specific reports describing the mineral resources in Torrance County also are few. Perhaps the best source describing all mineral resources in New Mexico is a compilation prepared by the U.S. Geological Survey (1965) in cooperation with numerous state agencies. Lindgren and others (1910) have described the ore deposits known to occur prior to 1910. Various energy and mineral-resource maps include Foster (1956), Foster and Grant (1974), Bieberman and Weber (1969), Siemers and Austin (1979), Logsdon (1982a), and U.S. Geological Survey and NMBM&MR (1981). Additional commodity reports concerning New Mexico mineral resources include reports on various deposits in Torrance County. Barite deposits have been described by Clippinger (1949), Williams and others (1964), Williams (1965, 1966), and T. J. Smith (1982). Fluorite deposits have been described by Ladoo (1927), Johnston (1928), Rothrock and others (1946), Van Alstine (1965), Williams (1966), and McAnulty (1978). Iron deposits have described by Harrer and Kelly (1963), Kelley (1949), and Sheridan (1947). Stratabound, sedimentary copper deposits have been described by Soulè (1956), E. C. Anderson (1957), Collins and Nye (1957), Phillips (1960), LaPoint (1974, 1976, 1979), and McLemore (1982, 1983a). Aggregate resources have been described by the New Mexico State Highway Department (1975). Additional

commodities have been described briefly in other reports as cited. Five reports describe the mineral-resource potential of two different wilderness areas in the Manzano Mountains (Maxwell and Wobus, 1982a, b; Maxwell and others, 1983; Maxwell and Light, 1984; and Krason and others, 1982). Leasable mineral-land classification maps have been done by DeCicco and Patterson (1980a, b) and DeCicco and others (1978, 1979).

As part of the Department of Energy's NURE program, much of Torrance County was examined as part of 1- by 2-degree topographic quadrangle reports. Torrance County lies in four 1- by 2-degree quadrangles: Albuquerque, Socorro, Ft. Sumner, and Santa Fe (Fig. 6); specific reports concerning these quadrangles are listed in Table 1. A magnetic contour map (Fig. 23) was compiled from the ARMS data and a gravity map of the area was published by Cordell and others (1982).

Acknowledgments

This project was sponsored by the Bureau of Land Management (BLM) and the NMBM&MR. The coordinator for the BLM was James Turner who offered many suggestions and provided some of the basic data needed to compile this report. Many people on the NMBM&MR staff assisted greatly in preparing this report. Lynn Brandvold and associates and K. B. Faris provided chemical analyses in a short period of time. David Menzie obtained a few theses concerning the Manzano Mountains. Robert North, James Barker, and James Turner (BLM) assisted the author in the field on various occasions. Kathy Parker and James Brannan drafted most of the figures and Lisa Zangara and Lynne McNeil typed the

Figure 6—Index to 1:250,000 scale (1- by 2- degree) topographic quadrangles covering Torrance County

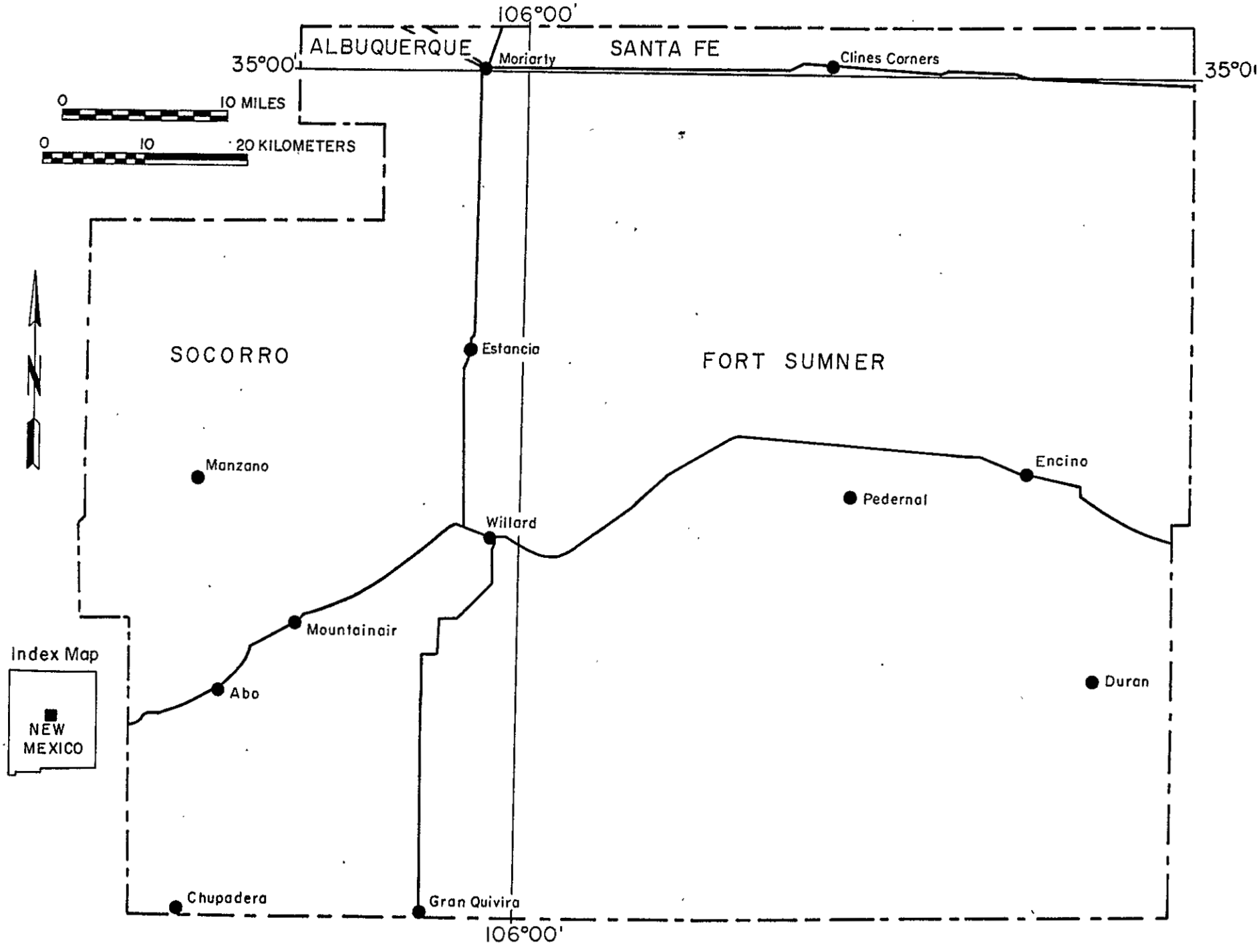


Table 1 - NURE reports pertaining to portions of Torrance County.

	Albuquerque	Socorro	Fort Sumner	Santa Fe
HSSR	Olsen (1977), Maason and Bolivar (1979)	Planner (1980)	Union Carbide, MC. (1981)	Bolivar (1980b)
ARMS	Geometrics, Inc. (1979a)	Geodata International Inc. (1979)	Carson Helicopter, Inc. (1981)	Geometrics, Inc. (1979b)
Folio Reports	Green and others (1982)	Pierson and others (1982)	none	Reid and others (1982)

NURE - National Uranium Resource Evaluation
HSSR - Hydrogeochemical and Stream-Sediment Reconnaissance
ARMS - Aerial-Radiometric and Magnetic Surveys

manuscript. This manuscript was edited by Deborah Shaw. Ron Broadhead offered many suggestions in assessing the petroleum potential. This manuscript benefited from critical reviews by Richard Chamberlin, George Austin, JoAnne Osburn, Gary Johnpeer, Ron Broadhead, Robert North, and James Turner. Discussions with Richard Chamberlin and Robert North were extremely helpful.

I also would like to thank Charles Maxwell of the U.S. Geological Survey for providing copies of his publications on the Manzano Wilderness. Jeremy Setter of KRITI, Inc., provided a few chemical analyses and mineral-occurrence locations from the Pedernal Hills. Michael Madson (Bendix Field Engineering Corp.) provided the NURE data and offered suggestions for interpreting this data. Paul Garding of the Bureau of Indian Affairs accompanied the author onto the Isleta Pueblo to visit the Milagros gold mine.

Finally, Kent Anderson, Robert Colpitts, and Vivian Gomez (New Mexico Institute of Mining and Technology) assisted in xeroxing, proofreading, compiling the bibliography, and compiling the mineral occurrences. Robert Colpitts assisted in compiling maps of Favorable Geologic Formations for nonmetallic commodities (Figs. 26 - 31) and the structure-contour map of the Precambrian rocks (Fig. 32). He also assisted with the evaluation of the petroleum-resource potential.

Lithologic units in Torrance County range in age from Precambrian to Recent and many of the stratigraphic intervals contain mineral or other commodity deposits (Table 2; Dane and Bachman, 1965). A brief synopsis of the lithologic units and geologic history is presented in this section, with emphasis on units containing deposits, in order to give a more complete understanding of the resources.

Precambrian rocks are the oldest rocks exposed in Torrance County and are possibly the most important host rocks and sources for many mineral deposits (Table 2). The known Precambrian geologic history is fragmentary throughout central New Mexico because these complex rocks are highly deformed and discontinuously exposed. In Torrance County, Precambrian rocks are found in the Manzano Mountains, the Pedernal Hills, and several small, isolated highlands in central and eastern Torrance County (Condie, 1981; Kelley, 1972). Stratigraphic correlations of Precambrian units are uncertain and must be used with extreme caution because of: (1) complex structural histories; (2) multiple episodes of metamorphism and other deformation; (3) poor and limited exposure; (4) pseudostratigraphic relationships produced by major tectonic events; and (5) disruption of stratigraphic sequences by burial, erosion, younger intrusives, and tectonic events. Further complicating interpretation of the Precambrian history is the absence of detailed geologic mapping in many areas of Precambrian exposure.

Age dates of Precambrian rocks in central New Mexico are

Table 2 - Stratigraphic units and associated economic commodities in Torrance County.

Age	Group, Formation, Member, or rock unit	Description	Potential economic commodities present
Quaternary	valley alluvium and assorted surficial deposits	stream gravels and sediments, alluvial plain deposits	sand and gravel, adobe
	eolian deposits	sand and gypsum dune deposits	sand, gypsum
	lake and playa deposits	lake sediments up to 100 ft thick	salt
	terrace deposits, caliche	gravel capped surfaces or benches paralleling streams	sand and gravel, dimension stone
Tertiary	Ogallala Formation	sand, gravel, silt, clay, and caliche deposits 15 to 50 ft thick	sand and gravel, caliche
	igneous intrusives, dikes, and sills	few, small, scattered dikes and sills-monzonite, andesite, diabase, diorite, mafic compositions	iron-replacement deposits
Triassic	Chinle Formation	continental red shales and siltstones, 200-1,300 ft thick	----------
	Santa Rosa Sandstone	continental sandstone, 100-350 ft thick	----------
Permian	Artesia Group - Grayburg and Queen Formations	sandstones, mudstones, and some gypsum, 0-400 ft thick	----------
	San Andres Formation	marine unit up to 1,100 ft thick	dimension stone,
	Fourmile Draw Member	dolomite, gypsum, and minor mudstone	limestone, gypsum
	Bonney Canyon Member	finely crystalline limestone	limestone
	Glorieta Sandstone Member	relatively pure quartz sandstone	high silica sand
	Yeso Formation	0-1,400 ft thick	gypsum, limestone, petroleum barite-fluorite veins
	Joyita Sandstone Member	siltstone and sandstone	
	Cañas Gypsum Member	gypsum with siltstone, sandstone, limestone	gypsum
	Torres Member	limestone, sandstones, gypsum	copper stratabound deposits
	Meseta Blanca Sandstone Member	sandstone and local siltstone	
	Abo Formation	continental sequence, 0-800 ft thick	copper (uranium, gold, silver) stratabound deposits, petroleum
	Madera Group		
	Bursum Formation	marine shales, sandstones, and limestones	dimension stone copper, uranium, gold, silver stratabound deposits, limestone
Pennsylvanian	Wild Cow Formation Sol se Mete, Pine Shadow, and La Casa Members	alternating sequences of sandstone, conglomerate, siltstone, shale, and calcarenite	petroleum
	Los Moyos Limestone	limestones	limestone, barite-fluorite
	Sandia Formation	siltstone, sandstones, conglomerates, and marine limestones	CO_2, petroleum
Precambrian	Manzano Mountains	complex basement lithologies	gold and silver in greenstones?, copper and lead veins (± Au, Ag) dimension stone, massive sulfide deposits?
	Pedernal Hills		U-Th veins, copper veins, gold and silver in greenstones?, massive sulfide deposits?, dimension stone
	Miscellaneous areas		U-Th veins, dimension stone
	Subsurface		CO_2 in Estancia Valley

sparse, but available dates indicate emplacement of granitic rocks in Torrance County from about 1.6 to 1.4 b.y. (Armstrong and Holcombe, 1982; Brookins, 1982; Brookins and others, 1980; White, 1978; Bolton, 1976; Mukhopadhyay and others, 1975). Schists and metavolcanic rocks are about 1.7 to 1.5 b.y. in age (Bowring and others, 1983; Bowring and Condie, 1982; Armstrong and Holcombe, 1982). Post-metamorphic syenite bodies have been dated as 469 ± 7 m.y. (Loring and Armstrong, 1980), suggesting that metamorphism occurred prior to Early Paleozoic time. The Ordovician age date of these syenites suggests that alkalic magmatism similar to alkalic-carbonatite magmatism in Colorado may have affected central Torrance County (Loring and Armstrong, 1980).

The oldest Precambrian units in the Manzano Mountains in Torrance County include a sequence of greenstones, phyllites, argillites, metavolcanic rocks, and minor talc that compose the Hell Canyon greenstone (Cavin and others, 1982; Parchman, 1981; Edwards, 1978). The Hell Canyon greenstone is exposed only in northern Torrance County and is intruded by the Ojita granitic pluton (Condie and Budding, 1979). A sequence of quartzites, schists, and phyllites from the Sais Quartzite, the Blue Springs and White Ridge Formations, and a younger sequence of metarhyotite, amphibolite, and basic schists from the Sevilleta Formation occur in the southern Manzano Mountains (Bauer, 1982; Stark, 1956; Reiche, 1949). These units are intruded by the Monte Largo and Priest granitic plutons (Condie and Budding, 1979). Gold-bearing quartz veins with minor copper mineralization are found in the Hell Canyon greenstone and

metamorphic rocks in the southern Manzano Mountains. Excellent quality dimension or building stone can be obtained from some of the metamorphic units.

Three granitic plutons, Ojita, Monte Largo, and Priest, are exposed in the southern Manzano Mountains (Stark, 1956). Petrographic and geochemical data suggest that the Ojita and Monte Largo plutons are probably part of the same intrusion (Condie and Budding, 1979; Stark, 1956). All three plutons are characterized by high CaO and intermediate SiO2 and K_2O content. These granites and quartz monzonites are geochemically similar to high-calcium granites (Condie and Budding, 1979; Condie, 1978). Mineralization is rare in all three of these granitic plutons.

The Pedernal Hills are underlain by a complex sequence of Precambrian metavolcanic and metasedimentary rocks and the Pedernal granitic pluton (Armstrong and Holcombe, 1982). Previous workers identified these metamorphic rocks simply as schists, cataclastic rocks, heterogeneous rocks, quartzites, and granites (Condie and Budding, 1979; Woodward, 1968; Gonzalez and Woodward, 1972; Gonzalez, 1968; Fallis, 1958). Although the geologic history during the Precambrian is speculative, available lithologic descriptions indicate that deposition of quartzose and argillaceous sediments was periodically interrupted by the deposition of volcanic units, primarily basaltic rocks subsequently metamorphosed to greenstones.

Field, petrographic, and geochronologic evidence suggest that the Pedernal pluton is younger than adjacent metavolcanic and metasedimentary rocks (Gonzalez, 1968; Armstrong and

Holcombe, 1982). Petrologic composition of the pluton varies from porphyritic granite to alkali granite to quartz monzonite (Gonzalez and Woodward, 1972; Condie and Budding, 1979). Samples from the Pedernal pluton have chemistries typical of high-silica, low rare-earth element granites (Condie, 1978; Condie and Budding, 1979). Small pegmatite, aplite, and syenite dikes intrude the pluton.

Geologic information concerning the several small, scattered exposures of Precambrian rocks in central and eastern Torrance County is inadequate for mineral-resource potential determination. Pink granite or granitic gneiss is the dominant rock type found in most of these exposures; however, greenstones, diabases, and schists are found at several localities (Kelley, 1972). A syenite body and a thin carbonatite dike occur in the northern portion of Lobo Hill. The carbonatite is similar in appearance, mineralogy, and composition (Table 3) to the Lemitar carbonatites in Socorro County.

Lower and middle Paleozoic sedimentary rocks are absent in Torrance County because of nondeposition or erosion. The oldest sedimentary unit exposed is a thin, nonfossiliferous limestone that lies unconformably on Precambrian granite in the Manzano Mountains. The limestone is about 22 ft (7 m) thick and is correlated with either the Mississippian Caloso or Arroyo Penasco Formations (Armstrong, 1955, 1958, 1962) or Pennsylvanian Sandia Formation (Myers and McKay, 1971). Elsewhere in the Manzano Mountains, clastic sediments of the Sandia Formation unconformably overlie the Precambrian rocks.

Table 3 - Chemical analysis of the Lobo Hill carbonatite

Oxide %	Lobo Hill[1]	Lemitar Mountains[2]	Average Carbonatite (Heinrich, 1966)	Average Carbonatite (Gold, 1966)
SiO_2	12.08	12.5	10.3	5.47
TiO_2	0.23	0.47	0.73	0.50
Al_2O_3	3.25	2.72	3.29	1.77
Fe_2O_3	5.50	3.74	3.46	3.88
FeO	1.04	4.63	3.60	3.71
MgO	0.64	8.23	5.79	6.10
CaO	41.94	31.5	36.1	37.06
Na_2O	0.46	0.34	0.42	1.09
K_2O	0.33	0.67	1.36	0.87
MnO	-	0.60	0.68	0.78
P_2O_5	0.03	3.16	2.09	1.73
CO_2	32.64	27.4	28.5	31.16
Total	98.14	95.96	96.32	94.12
Trace elements (ppm)				
Li	3	29	-	15
Ni	28	38	8	32
Cu	2,900	12	2.5	88
Zn	138	218	-	160
Ba	160	333	450-1,120	4,000
Cr	10	16	48	120
Co	67	36	17	19
U	1,080	7.5	-	57

1 - analyses by Lynn Brandvold and associates, 2/84
2 - average primary magmatic silicocarbonatite, Lemitar Mountains, Socorro County, (McLemore, 1983b)

Marine seas began to transgress into New Mexico during the late Paleozoic. The Sandia Formation represents the first stage of disposition and consists of a mixture of nonmarine siltstones, sandstones, and conglomerates and marine shales and limestones (Myers, 1982). The unit is approximately 90-320 ft (27-98 m) thick at the surface and approximately 230-320 ft (70-98 m) thick in the subsurface in Torrance County. Much of the terrigenous material was probably derived from the rising Pedernal uplift (Kelley, 1972). The lower, discontinuous limestone member of the Sandia Formation is not exposed in Torrance County (Bates and others, 1947; R. E. Smith, 1957), except perhaps at Bosque Peak. Carbon dioxide (CO_2) and petroleum may occur in the Sandia Formation at depth.

The Madera Group overlies the Sandia Formation and is the major marine sequence in the Pennsylvanian and lower Permian. The Madera Limestone of Read and others (1944) has been raised to a group status in the Manzano Mountains (Myers, 1973, 1982) and consists of Los Moyos Limestone (oldest), Wild Cow Formation, and Bursum Formation (Permain). Los Moyos Limestone and Wild Cow Formation consist of marine limestones with interbedded siltstones, shales, sandstones, and conglomerates (Myers, 1973, 1982). The Madera Group is approximately 1,200-1,270 ft (366-387 m) thick. Many of these marine limestones are potential sources for aggregate rock, building stone, and the materials to manufacture cement.

The Bursum Formation is the uppermost unit of the Madera Group and is the last phase of marine deposition that dominated the Pennsylvanian. The Bursum Formation consists of more than

100 ft (30 m) of alternating sequences of red arkosic sandstones, red and green shales and siltstones, and greenish-gray marine limestones (Myers, 1973, 1982). Minor occurrences of copper mineralization are common in the upper beds of the Bursum Formation in the Scholle district.

The Abo Formation (Permian) gradationally overlies the Bursum Formation and consists of up to 915 ft (279 m) of dominantly reddish-brown continental deposits (red beds). The Abo Formation grades upward from a sequence of sandstones, siltstones, and shales to a finer-grained sequence of mudstones and siltstones. The depositional environments change from high-energy alluvial-fan and pediment deposits in the lower member to low-energy fluvial flood plain and shallow-water lacustrine deposits in the middle and upper members (Hatchell and others, 1982). Copper deposits with associated silver, lead, gold, uranium, and vanadium occur in the lower member of the Abo Formation.

The Yeso Formation (Permian) gradationally overlies the Abo Formation and locally it unconformably overlies Precambrian rocks in southwestern and central Torrance County (Kelley, 1972; Hunter and Ingersoll, 1981). As marine seas encroached upon the area, up to 1,400 ft (427 m) of alternating sequences of gypsum, limestone, siltstone, and sandstone were deposited in near-shore, marginal-marine environments. The Yeso Formation is divided into four members (in ascending order): Meseta Blanca Sandstone, Torres, Canas Gypsum, and Joyita Sandstone. Gypsum resources are abundant in the Torres and Canas Gypsum Members. Copper deposits occur in the Meseta Blanca Sandstone Member.

When the San Andres Formation was deposited (late Permian time), the Pedernal uplift and central Torrance County were almost completely inundated by marine seas. The San Andres Formation is approximately 1,100 ft (335 m) thick, and it is divided into three members (in ascending order): Glorieta Sandstone, Bonney Canyon, and Fourmile Draw (Kelley, 1972). The Glorieta Sandstone Member consists almost entirely of sandstones deposited in eolian, fluvial-deltaic, beach, and off-shore sand-bar environments (Milner, 1978). Locally, the Glorieta contains relatively pure quartzites containing up to 97% quartz (Perhac, 1964, 1970; Milner, 1978). Elsewhere the Glorieta may be iron stained and contain iron concretions, ironstone, hematite, or brown chert (Kelley, 1972). Typically, the Glorieta is overlain by the Bonney Canyon Member, although locally it may be overlain by the Fourmile Draw Member. The Bonney Canyon Member consists of fossiliferous marine limestones and dolomites with minor sandstone interbeds. The Fourmile Draw Member consists of interbedded dolomite and gypsum with minor shale beds. Karst topography and sinkholes are common. Limestone, dolomite, caliche, and gypsum are common resources in both the Yeso and San Andres Formations.

In eastern Torrance County, a thin stratigraphic interval representing the Grayburg and Queen Formations (Permian) is preserved. These units consist of reddish-brown and tan sandstones with some gypsum and dolomite. In eastern New Mexico, marine units of the Seven Rivers Formation and near-shore units of the Yates Formation were deposited, but these units do not extend into Torrance County (Kelley, 1972).

Continental deposits of the Triassic Santa Rosa Sandstone and Chinle Formation are exposed in eastern Torrance County (Kelley, 1972). The Santa Rosa Sandstone consists of fluvial sandstone and conglomerate, whereas the Chinle Formation consists of shales and siltstones with minor fluvial sandstones. Cretaceous through Early Tertiary rocks are not present in Torrance County. The Pedernal highland was probably rejuvenated during this period.

Local warping and folding of some sedimentary units and the rise of the Pedernal uplift are evidence that the Laramide orogeny affected this area (Kelley, 1972). In early to mid-Tertiary time, basalt, diabase, diorite, and monzonite dikes and sills intruded older sedimentary rocks; iron-rich deposits and folding of adjacent sediments may be associated with these intrusives. The Manzano Mountains were uplifted during this period.

During the Miocene and Pliocene, the Ogallala Formation was deposited unconformably on Precambrian and Paleozoic rocks (Frye and others, 1982; Bretz and Hornberg, 1949). The Ogallala Formation consists of silt, clay, caliche, sands, and coarse gravels that were deposited in alluvial fans and stream environments. Good quality aggregate deposits are found in this unit.

The Estancia Valley probably formed during the late Miocene and Pliocene when the Manzano Mountains were uplifted to form the eastern edge of the Rio Grande rift. Paleolake Estancia formed between 18,000 to 10,500 years B.P. during the Wisconsin glacio-

pluvial period (Bachhuber, 1971, 1982; Smith and Anderson, 1982). The lake's maximum extent was about 35 mi (56 km) long and 23 mi (37 km) wide (Meinzer, 1912). Shore features, cliffs, terraces, beach ridges, and other lake features are preserved in the Estancia Valley. Similar basins were formed at Encino Wells and Pinos Wells (Kelley, 1972).

During Quaternary time, the desiccation of these lakes resulted in the land forms present today. Sand dunes, many containing up to 80% gypsum, formed around the playa lakes and salt deposits formed on the playa surface. The lake deposits are approximately 100 ft (30 m) thick (Titus, 1969; Kelley, 1972; Bachhuber, 1971, 1982). Additional quaternary units also include: (1) terrace, valley, and stream deposits; (2) gravel-capped surfaces or benches that parallel streams; (3) several dune fields that offer potential sources of sand; and (4) valley fill and stream deposits (Kelley, 1972).

MINING HISTORY

The earliest account of mining activity in Torrance County is of salt mining in the Estancia Basin. As early as 1660, salt was being shipped 700 mi (1,127 km) to the silver mines in Chihuahua, Mexico (Northrop, 1959). The first modern, commercial salt-mining operation was established in 1915 and salt was produced until at least 1933. Total salt production is not known.

Various other commodities have been produced from Torrance County. By 1902, stratabound, sedimentary copper deposits were discovered in the Scholle district in western Torrance County (Fig. 1). Production from the district began in 1915 and continued sporatically until 1961. More than $255,000 worth of copper, silver, gold, lead, and radium was produced from this district (U.S. Geological Survey, 1914-1931; U.S. Bureau of Mines, 1932-1981). Carbon dioxide (CO_2) was discovered in the Estancia Basin in 1925 and from 1934 until 1942 CO_2 was produced from several wells. In 1956, barite was produced from the Shockley mine in northwest Torrance County. Iron ore was produced from the Chupadera Mesa deposits in southwestern Torrance County in 1964, 1966, 1972, 1973, and 1975. By far the most important production has been of sand and gravel, stone, and related construction materials. Between 1954 and 1980, more than 4 million dollars worth of construction materials were produced (U.S. Bureau of Mines, 1932-1981).

Mineral production from Torrance County has not been substantial when compared to most counties in New Mexico. Still,

from 1953 until 1980, more than 4.8 million dollars worth of sand and gravel, stone, iron ore, copper, silver, and gold has been produced from Torrance County (Table 4). Sand and gravel, stone, and other construction materials will continue to be the dominant commodities produced in Torrance County.

Present mining claims and exploration activity

As of July 14, 1983, 32 groups of mining claims are considered active in Torrance County (Table 5; Fig. 7). These claims are scattered throughout the county and include portions of the Pedernal Hills and the Scholle district. Much of the leasable Federal land for oil and gas has been leased, although no wells have been drilled since 1980 (Appendix 2). The only active producing mines are several sand and gravel operations along Interstate 40 and U.S. Highway 60.

Table 4 - Total Value of Mineral Production in Torrance County, New Mexico, 1953 to 1980. Compiled from U.S. Bureau of Mines (1953-1980).

Year	Value (dollars)[1]	Commodities[2]
1953	0	
1954	53,211	sand and gravel, Ag
1955	0	
1956	572,870	
1957	1,093,392	sand and gravel, stone
1958	496,000	sand and gravel, stone
1959	618,932	sand and gravel, stone
1960	111,200	sand and gravel
1961	74,760	sand and gravel, stone, Cu
1962	W	sand and gravel
1963	0	
1964	272,000	sand and gravel
1965	172,000	sand and gravel
1966	W	sand and gravel, stone, Fe
1967	59,000	sand and gravel
1968	W	sand and gravel, stone
1969	363,000	sand and gravel, stone
1970	W	sand and gravel, stone
1971-72	W	sand and gravel
1973	175,000	sand and gravel, Fe
1974	178,000	sand and gravel, Fe
1975	W	sand and gravel, Fe
1976	204,000	sand and gravel, stone
1977	163,000	sand and gravel, stone
1978	124,000	sand and gravel
1979	124,000	sand and gravel
1980	13,000	stone
TOTAL (1953-1980)	4,867,365	(does not include W values)

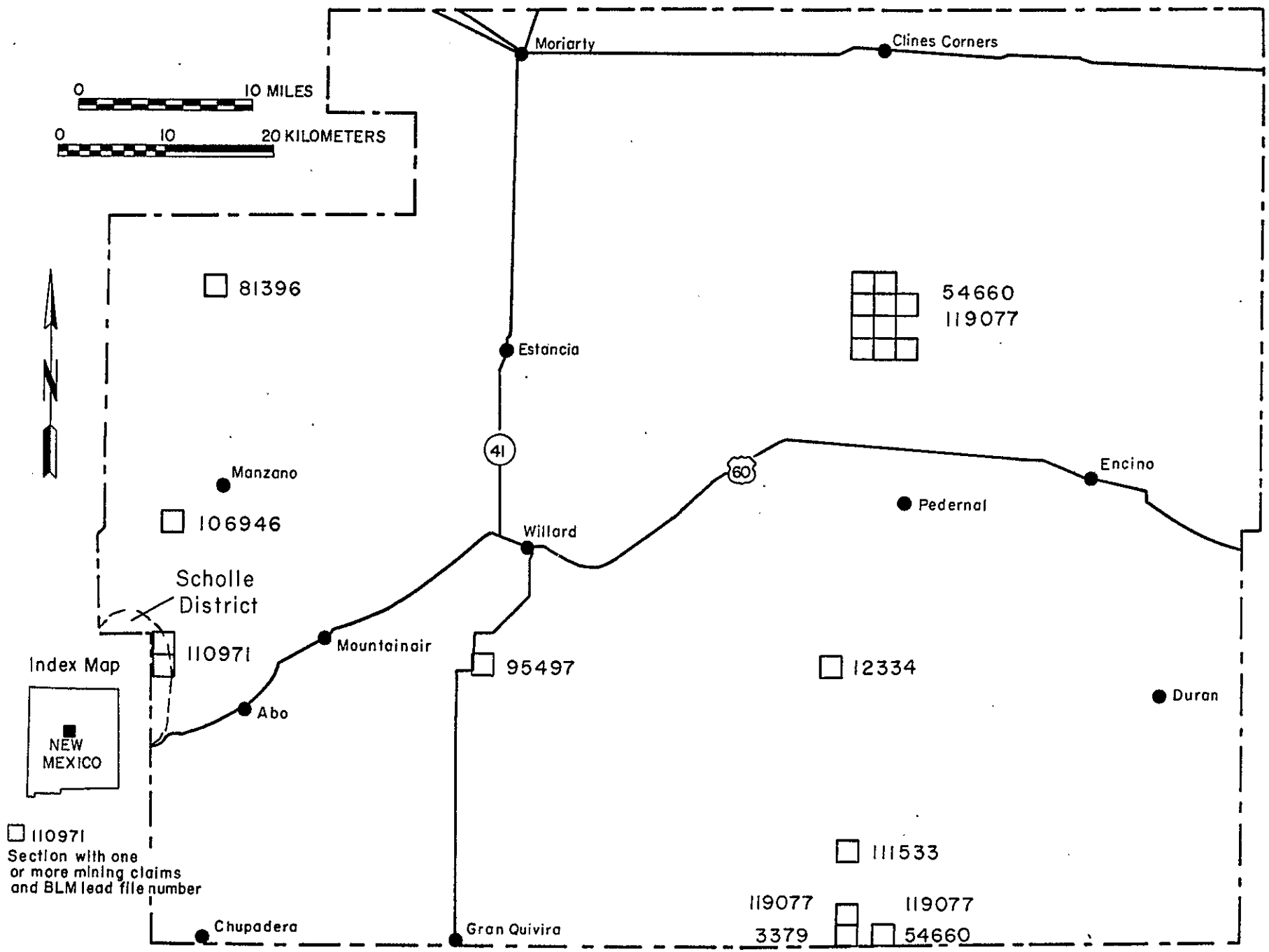
[1] W - withheld
[2] Ag - silver, Cu - copper, Fe - iron ore

Table 5 - Active mining claims in Torrance County as of July 14, 1983 (Fig. 7; BLM files).

Location	Claim name	Claimant	Lead file	Location date
3 T2N R5E	BO #3-5	James R. Anderson	110971	9/2/81
10 T2N R5E	BO #6-10	James R. Anderson	110971	9/2/81
35 T5N R5E	Manzano #1	Charles Daniels	106946	6/23/81
19 T7N R6E	Troncon Negro	Dennis and Michael Pohl	81396	10/14/79
11 T3N R8E[1]	Pamela #1-10	Dela Rosa Brothers	95497	4/19/80
5 T1N R12E	Lincoln #1-8	Oroplata Investments	111533	7/27/81
29 T1N R12E	Oro Plata #8, 9	Oroplata Claims	107029	5/1/81
29 T1N R12E	Cougar #16-17	Oroplata Investments	111525	7/27/81
32 T1N R12E	Oro Plata #3-7	Oroplata Claims	107029	5/1/81
32 T1N R12E	Cougar #10-15	Oroplata Investments	111525	7/27/81
34 T1N R12E	Oro Plata #2	Oroplata Claims	107029	5/1/81
7 T3N R12E[1]	Tortilla #1-18	Conoco, Inc.	12334	11/30/77
3 T6N R12E	Ped No. 185-202	Conoco, Inc.	54660	3/27/76
4 T6N R12E	Ped No. 221-240	Conoco, Inc.	3379	3/9/77
4 T6N R12E	Susan #131-151	El Shaddai, Inc.	119077	4/26/82
5 T6N R12E	Ped No. 203-220	Conoco, Inc.	54660	7/11/76
5 T6N R12E	Susan #152-168	El Shaddai, Inc.	119077	4/26/82
20 T7N R12E	Ped No. 66, 68, 70, 72, 119-126, 150-151	Conoco, Inc.	54660	3/25/76
20 T7N R12E	Susan #111-112	El Shaddai, Inc.	119077	4/25/82
21 T7N R12E	Ped No. 11-18, 65-72	Conoco, Inc.	54660	3/24/76
21 T7N R12E	Susan #37, 38, 75, 76	El Shaddai, Inc.	119077	4/24/82
27 T7N R12E	Ped No. 167-184	Conoco, Inc.	54660	3/27/76
28 T7N R12E	Ped No. 19-36, 78-90	Conoco, Inc.	54660	3/24/76
28 T7N R12E	Susan #19-36, 57-74	El Shaddai, Inc.	119077	4/24/82
29 T7N R12E	Ped. No. 74, 76, 78, 80, 82, 84, 86, 88, 90, 127-144, 151-166	Conoco, Inc.	54660	3/25/76
29 T7N R12E	Susan #93-130	El Shaddai, Inc.	119077	4/25/82
32 T7N R12E	Ped No. 241-256	Conoco, Inc.	3379	3/18/77
32 T7N R12E	Susan #77-92	El Shaddai, Inc.	119077	4/25/82
33 T7N R12E	Ped No. 37-54, 91-108	Conoco, Inc.	54660	3/26/76
33 T7N R12E	Susan #1-56	El Shaddai, Inc.	119077	4/24/82

[1] Case closed 1983 by BLM

Figure 7 – Sections with active claims in Torrance County as of July 14, 1983 (see Table 5; BLM files)



INTERPRETATION OF THE NURE GEOCHEMICAL DATA

The HSSR survey of the NURE program consists of geochemical surveys for each of the 1- by 2-degree topographic quadrangles in New Mexico and for selected pilot and special study areas. Four quadrangle reports (Table 1) and one pilot study (Olsen, 1977) cover portions of Torrance County. The HSSR program was initially designed for regional uranium exploration and assessment of uranium potential. One sample was taken approximately every 10 km^2 and this sample density was believed adequate for reconnaissance work aimed at delineating favorable areas for uranium exploration (Bolivar, 1981).

Analytical procedures employed were optimized to search for uranium anomalies. Detection limits of uranium by delayed neutron counting were about 0.01 to 0.02 ppm and analytical errors were typically less than 10%. Later, the HSSR program was broadened to include multi-element analyses for many water and all stream-sediment samples. The analytical methods employed were designed for rapid determination of as many elements as possible and differed from laboratory to laboratory, but detection limits varied for each element and for each analytical procedure (Bolivar, 1980a, 1981). Detection limits of some elements (such as gold and silver) were too high to detect low concentrations typically found in nature and only anomalously high concentrations of these elements could be detected. Analytical errors were about 20% for concentrations approximately one order of magnitude above the detection limit and up to 50%

for concentrations close to the detection limit (Bolivar, 1980a, 1981).

Workers at two laboratories, Los Alamos Scientific Laboratory and Oak Ridge Gaseous Diffusion Plant, collected and analyzed samples from New Mexico (Union Carbide, Corp., 1981). Analyses of samples from the Albuquerque, Socorro, and Santa Fe quadrangles were determined at Los Alamos and the analyses from the Ft. Sumner quadrangle were determined at Oak Ridge. Specific analytical methods, corresponding detection limits, and approximate ranges in Torrance County samples are summarized for each laboratory in Table 6. Statistical summaries for the pilot study of the Estancia Valley for each of the four 1- by 2-degree quadrangles (Table 1) and for all four quadrangles combined are in Appendix 3.

In addition to the HSSR surveys, geochemical stream-sediment and water surveys were conducted as part of the NURE evaluation of the Socorro quadrangle (Pierson and others, 1982) and as part of a mineral-resource assessment of the Manzano Wilderness (Maxwell and Wobus, 1982b). The analyses were determined by semiquantitative emission spectrometry. Statistical summaries of data from these reports also are included in Appendix 3 for comparison.

Only stream-sediment data were evaluated in detail for this project. Water data were not used except to confirm geochemical patterns observed in stream-sediment samples for the following reasons: (1) only two quadrangles included multi-element analyses of water samples (Albuquerque and Ft. Sumner), (2) the

sources of the ground water are difficult to determine, and (3) only a few surface waters were collected.

A geochemical anomaly is defined as any value above an arbitrarily chosen threshold value and is presumed to be produced by (1) economic mineral deposits, (2) subeconomic mineral deposits or occurrences, or (3) false anomalies due to analytical or sampling errors, to sample contamination, to lithologic differences, or to pollution or other cultural effects. It is also possible that geochemical anomalies are absent in areas known to contain mineral deposits. This is partly due to the wide spacing of sample sites in the reconnaissance HSSR data.

The threshold values for the purposes of this report are determined from simple statistics and statistical plots (Madson and others, 1983; Beyth and others, 1980) and from published averages of the earth's crust and various rock types (Levinson, 1974, table 2-1). Graphical selection of a threshold value from a lognormal probability plot (Sinclair, 1974) was used in most cases. This value was rounded to the nearest multiple of 1, 2, or 5 to make the threshold values consistent with the quaisi-log intervals used in plotting the HSSR data (Madson and others, 1983). The threshold values for some elements were arbitrarily chosen based on the upper limit of the normal variation in the data and the average crustal abundance (Levinson, 1974). These elements did not have typical lognormal distribution plots. The threshold values determined for each element are given in Table 6 and represent local concentrations above normal background for this particular area. Threshold values and geochemical anomalies

may vary according to rock type, local geology, drainage system, cultural influences, or other factors and will differ in other geographic regions. Geochemical anomalies from the NURE quadrangle and pilot study data are summarized in Figure 8 and described individually in Appendix 4. Geochemical anomalies from the Manzano Wilderness data are summarized in Figure 9.

Clusters of uranium anomalies occur in four areas in Torrance County (Appendix 4): in playa lake sediments (Fig. 8, area A), in sediments from two separate drainages of the Manzano Mountains (areas B and C), and in the Scholle area (Fig. 8, area D). Uranium anomalies also occur in playa lake waters and well waters (Fig. 8, area A; Brookins and Olsen, 1977), well waters near Mountainair, well waters in the southern Pedernal Hills (Brookins and Olsen, 1977), and well waters in the Scholle area (Fig. 8, area D). Uranium concentrations in stream sediments range from 0.7 ppm to 10.7 ppm and in waters from 0.1 ppb to 334 ppb (Appendix 3).

The uranium anomalies in the playa lake sediments and waters in the closed Estancia Basin (Fig. 8, area A) are best explained by evaporative concentration of ground waters anomalously high in uranium. The playa floor typically coincides with the ground-water level and evaporation rates are high. Strontium and lithium anomalies also are associated with some of the uranium anomalies and are probably a result of the same process. The uranium-enriched ground waters can be derived from any of the highlands surrounding the Estancia Basin. One source may be the sedimentary copper-uranium deposits in the Abo Formation in the Scholle district. Uranium anomalies in ground waters near

Table 6 - Summary of NURE HSSR geochemical data. All analyses are in parts per million (ppm). Statistics for individual quadrangle reports and for the 4-quadrangle area are in Appendix 3.

	Los Alamos Laboratory[1]			Oak Ridge Plant[1]					
Element	Method[2]	Detection[3] limit	Approximate range in Torrance County	Method[2]	Detection[3] limit	Approximate range in Torrance County	Average in earth's crust[4]	Mean in 4-quadrangle area[5]	Anomaly threshold value[6]
Ag	XRF	5	below detection	PSE	2	below detection-7	0.07	2.24	ADL
Au	NA	0.01 - 0.10	below detection	-	-	-	0.004	-	ADL
B	-	-	-	PSE	10 - 20	<10 - 46	10	21	30
Ba	NA	230 - 400	296 - 1,264	PSE	2	159 - 854	425	856	800
Be	ES	1	<1 - 4	PSE	1	<1 - 4	2.8	1.79	5
Bi	XRF	5	<5 - 7	-	-	-	0.17	-	5
Cd	XRF	5	<5 - 6	-	-	-	0.2	-	5
Ce	NA	10	13 - 118	PSE	4 - 10	18 - 77	60	60	100
Co	NA	2	2.2 - 21.1	PSE	4	<4 - 24	25	7.89	20
Cr	NA	10 - 20	21 - 138	PSE	1	10 - 97	100	41.4	100
Cs	NA	1.5 - 2	1.2 - 7.7	-	-	-	3	-	5
Cu	XRF	10	10 - 47	PSE	2	3 - 1,239	55	21.8	50
Eu	NA	0.1 - 0.8	0.5 - 2.5	-	-	-	1.2	-	2
Hf	NA	1	4.6 - 48.2	PSE	15	45 - 44	3	12.68	50
La	NA	4 - 7	7 - 63	PSE	2	2 - 33	30	31	50
Li	ES	1	7 - 72	PSE	1	10 - 50	20	30.3	50
Lu	NA	0.1 - 0.3	0.2 - 1.0	-	-	-	0.50	-	0.5
Mn	NA	10	122 - 792	PSE	4	71 - 817	950	438	1,000
Mo	-	-	-	PSE	2	<4 - 4	1.5	2	5
Nb	XRF	20	<20 - 58	PSE	4	<4 - 15	20	9.8	20
Ni	XRF	15	<15 - 54	PSE	2	2 - 43	75	13	50
Pb	XRF	5	<5 - 252	PSE	4 - 10	<10 - 110	12.5	14.7	40
Rb	NA	25 - 30	34 - 115	-	-	-	90	-	90
Sb	NA	1 - 4	below detection	-	-	-	0.2	-	ADL
Sc	NA	0.1	2.2 - 18.7	PSE	1	1 - 8	16	6.40	20
Sn	XRF	10	<10 - 12	-	-	-	2	5.2	10
Sr	NA	300 - 390	50 - 3,538	PSE	1	32 - 2,158	375	179	200
Ta	NA	1 - 2	<2 - 4	-	-	-	2	3	5
Th	NA	0.8 - 2	<2 - 18	PSE	2	<2 - 14	10	9.4	20
Ti	NA	200 - 3,000	385 - 21,460	PSE	10	264 - 3,928	5,700	3,710	5,000
U	DNC	0.01	1.41 - 5.78	DNC	0.02	0.70 - 4.60	2.7	3.3	4
V	NA	5 - 18	<18 - 108	PSE	2	9 - 93	135	64	200
W	XRF	15	16 - 24	-	-	-	1.5	-	16
Y	-	-	-	PSE	1	2 - 37	30	10	30
Zn	NA	10 - 120	<10 - 380	PSE	2	6 - 167	70	57	150
Zr	-	5	-	PSE	2	10 - 151	165	64	100

1 Los Alamos released data for Albuquerque, Santa Fe, and Socorro quadrangles. Oak Ridge released data for Ft. Sumner quadrangle.

2 Method
XRF - X-ray fluorescence
NA - neutron activation
DNC - delayed neutron counting
ES - arc-source emission spectrography
PSE - plasma-source emission spectrometry

3 Lowest detectable concentration. However, the detection limit will shift because of elemental interferences and as a function of sediment composition (especially for neutron activation analyses).

4 Levinson (1974, Table 2-1)

5 Statistics from combined data from all four quadrangle reports

6 Anomaly threshold value for Torrance County determined from statistical calculations and average crustal abundance

DL - above detection limit

Figure 8 - Summary of geochemical anomalies from NURE HSSR data (see Table 6 and Appendix 4)

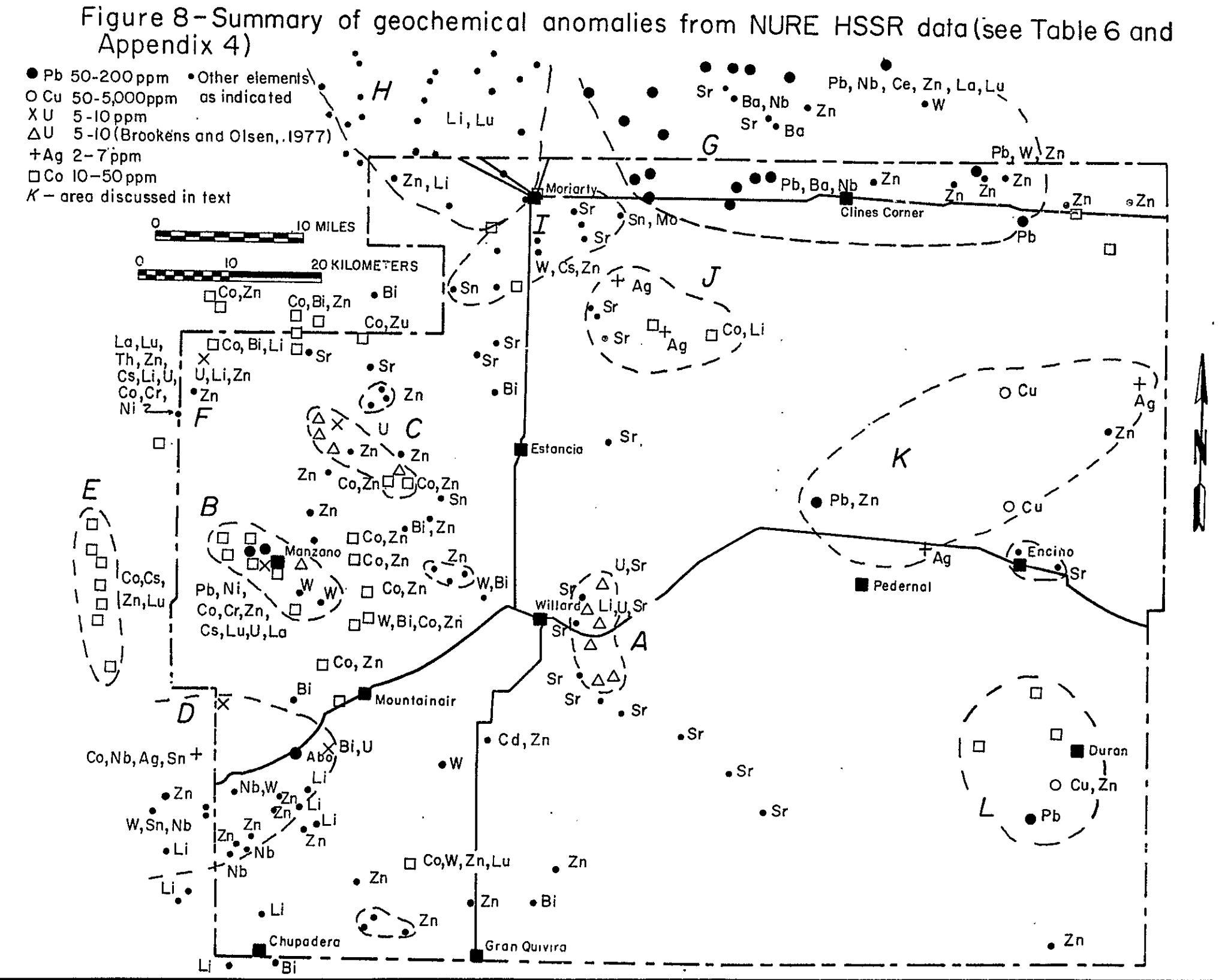
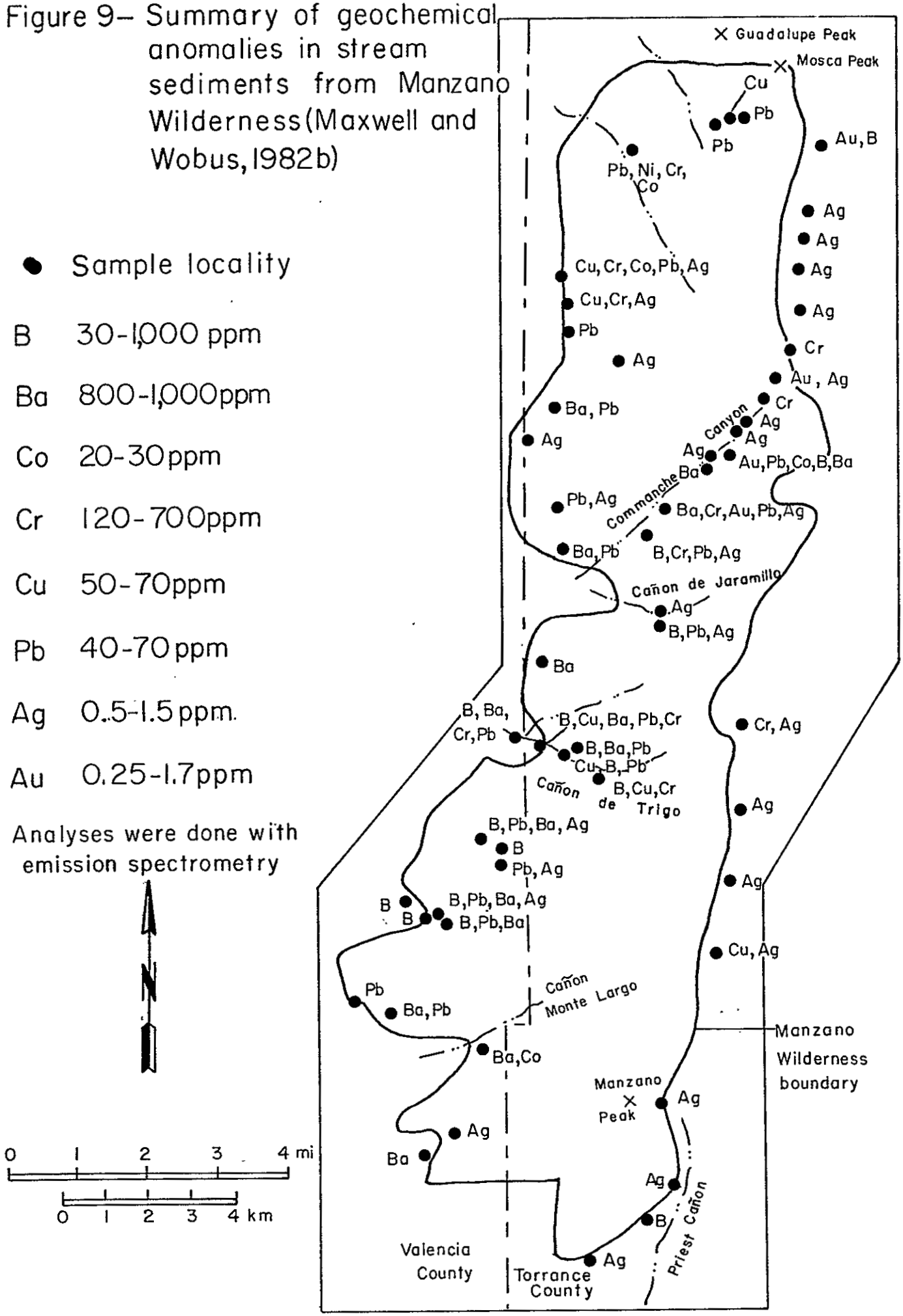


Figure 9– Summary of geochemical anomalies in stream sediments from Manzano Wilderness (Maxwell and Wobus, 1982b)



Mountainair could be from Abo sandstones and represent additional copper-uranium deposits. Also, uranium is associated with Paleozoic carbonatites and syenites in the Lobo and Pedernal Hills. Uranium anomalies in ground waters in the southern Pedernal Hills could be derived from the Precambrian rocks.

Uranium anomalies in stream sediments from drainages of the Manzano Mountains in area B (Fig. 8) also may be derived from concealed copper-uranium deposits in the Abo Formation. One occurrence of copper-uranium mineralization is found in the Abo Formation near this cluster of anomalies (Appendix 1) and mining claims also occur in the area (Fig. 7). Additional geochemical anomalies of lead, nickel, cobalt, chromium, zinc, cesium, lanthanum, and lutetium also occur in area B (Fig. 8). Cobalt is associated with many stratabound, sedimentary copper deposits (Gustafson and Williams, 1981) and the cobalt anomalies probably are related to these deposits. Lead and zinc anomalies also are related to the copper deposits. The nickel, chromium, cesium, lanthanum, and lutetium geochemical anomalies could be related to copper-uranium mineralization in the Abo Formation, but they also could be related to (1) shales of the Madera Group, (2) sulfide deposits in the Precambrian rocks, or (3) analytical error because some of these concentrations are close to the detection limit.

The cluster of uranium anomalies in stream sediments in area C (Fig. 8) is difficult to explain. A few zinc and cobalt anomalies occur within this cluster and a mining claim has been located upstream from area C (Fig. 8). Uranium mineralization is not known to occur in the Madera Group, except in the Bursum

Formation. Uranium and copper could occur in the Bursum Formation; however, a more likely source of these anomalies is the Precambrian rocks. This area warrants additional study.

Only two uranium anomalies and no copper anomalies in stream sediments are found in the Scholle area (Fig. 8, area D). However, bismuth, silver, tin, cobalt, niobium, tungsten, zinc, and lithium anomalies occur in the area (Fig. 8). A cluster of numerous uranium anomalies in water samples from the immediate vicinity of copper-uranium mineralization is found in both the NURE quadrangle data (Planner, 1980) and the quadrangle evaluation data (Pierson and others, 1982). Uranium and silver anomalies undoubtedly are related to the copper-uranium mineralization. Bismuth, tin, cobalt, tungsten, and zinc anomalies also could be related to this type of mineralization. However, niobium and lithium anomalies may suggest that the sediments were derived from pegmatites or granitic rocks enriched in niobium and lithium.

A few clusters of geochemical anomalies are found in the Manzano Mountains (Fig. 8, areas B, E, and F). Area B was previously discussed because uranium is found in that area. In area E, anomalous cobalt, cesium, zinc, and lutetium occur. Area F contains lanthium, lutetium, zinc, cobalt, lithium, uranium, thorium, cesium, chromium, and nickel anomalies. The significance of these anomalies is not known; however, these areas warrant follow-up studies because these geochemical anomalies may indicate base and/or precious metals deposition in Precambrian rocks or along faults in the Madera Group.

The detailed geochemical survey of the Manzano Wilderness (Fig. 9; Maxwell and Wobus, 1982b) was done in the southern Manzano Mountains near area E (Fig. 8). Gold, barium, boron, chromium, and lead anomalies occur in Canon del Trigo and Commanche Canyon (Fig. 9). Copper, silver, and lead anomalies are found in the northwestern portion of the Wilderness. In the southwestern portion of the Wilderness lead, barium, boron, and silver anomalies are found. Silver and copper anomalies occur along the eastern borders of the Manzano Wilderness and a gold anomaly occurs in the northeastern part (Fig. 9).

Gold-silver veins with copper mineralization occur in Precambrian greenstones in the Hell Canyon district a few miles north of the Torrance-Valencia county line in the Manzano Mountains. Copper mineralization is found in greenstones along the Torrance-Valencia county line. The only other area of mineralization known to occur in the Manzano Mountains is found in the southwestern portion of the Manzano Wilderness (Maxwell and Wobus, 1982a). Gold-silver veins occur along shear zones within Precambrian metavolcanic and metasedimentary rocks.

The geochemical anomalies found in the Manzano Mountains suggest that concealed sulfide mineralization may be present in the Precambrian terrane. Gold veins and massive sulfide ore deposits may occur in the Precambrian greenstones in the northern part of Torrance County. These geochemical anomalies also may suggest that barite-fluorite-lead-zinc veins could occur in limestones of the Madera Group which rest on the Precambrian rocks. Uranium may occur in any of these types of ore deposits.

A significant cluster of lead, zinc, niobium, cerium,

lanthanum, and lutetium anomalies is found in north-central Torrance County and extends into Santa Fe County (Fig. 8, area G). Additional samples in the vicinity are anomalous in barium (1,000-2,000 ppm). A barite-fluorite-galena vein occurs at El Cuervo Butte, Santa Fe County and this cluster of anomalies could be related to similar structure-controlled barite-fluorite-galena veins. These geochemical anomalies may also suggest that the sediments were derived from pegmatites, granites, or other feldspar-rich lithologies enriched in these elements.

A large area in northwestern Torrance County contains numerous lithium and lutetium anomalies (Fig. 8, area H). Both lithium and lutetium are typically enriched in shales relative to other rock types (Levinson, 1974, table 2-1) and this cluster of anomalies possibly indicates a lithologic association with shales of the Madera Group.

Geochemical anomalies cluster just south of the lithium-lutetium cluster (Fig. 8, area I) where cobalt, tungsten, cesium, zinc, tin, and strontium occur. One molybdenum anomaly occurs in the area. Samples were analyzed for molybdenum only in the Fort Sumner stream sediments. The significance of these anomalies is unclear at the present time.

Two silver anomalies occur in the vicinity of Lobo Hill (Fig. 8, area J). Strontium, lithium, and cobalt anomalies are also present. Very little is known about the Precambrian geology of Lobo Hill, although a carbonatite and a silver-bearing quartz vein occurs in the area (Appendix 1). Based on HSSR data, additional silver-bearing veins are possible in the area.

One lead-zinc geochemical anomaly is found in the Pedernal Hills (Fig. 8, area K). Two silver, one zinc, and two copper anomalies are found in drainages from the Pedernal Hills, and mining claims have been located in the area (Fig. 7). These widely scattered single point anomalies could be representative of mineralization in the Pedernal Hills; however it is extremely difficult to interpret such scattered data.

A cluster of cobalt, copper, zinc, and lead anomalies is found in southeastern Torrance County (Fig. 8, area L). These anomlies could be representative of mineralization concealed in Precambrian rocks or Tertiary intrusives in the vicinity (Kelley, 1972).

Additional single anomalies occur throughout Torrance County (Fig. 8), but their significance is not known at the present time. It is difficult to interpret single anomalies of zinc, bismuth, tungsten, cobalt, and lithium. These anomalies are best explained by lithologic differences and probably do not indicate any significant economic mineralization.

Although there are no gold or antimony anomalies, the possibility exists that gold deposits may occur, especially in the Manzano Mountains. As mentioned previously, the detection limit for these elements was too high to detect typical concentrations observed in nature. However, lead, zinc, cobalt, boron, silver, and other elements may be pathfinder elements indicating the presence of gold deposits. It is also interesting to note that no copper anomalies were found in the Scholle copper district in either the NURE quadrangle data (Planner, 1980) or the quadrangle evaluation study (Pierson and others, 1982). It

is certainly feasible that other concealed mineral deposits are undetectable by the NURE geochemical data.

DESCRIPTION OF MINERAL DEPOSITS AND MINERAL-RESOURCE POTENTIAL

Metals

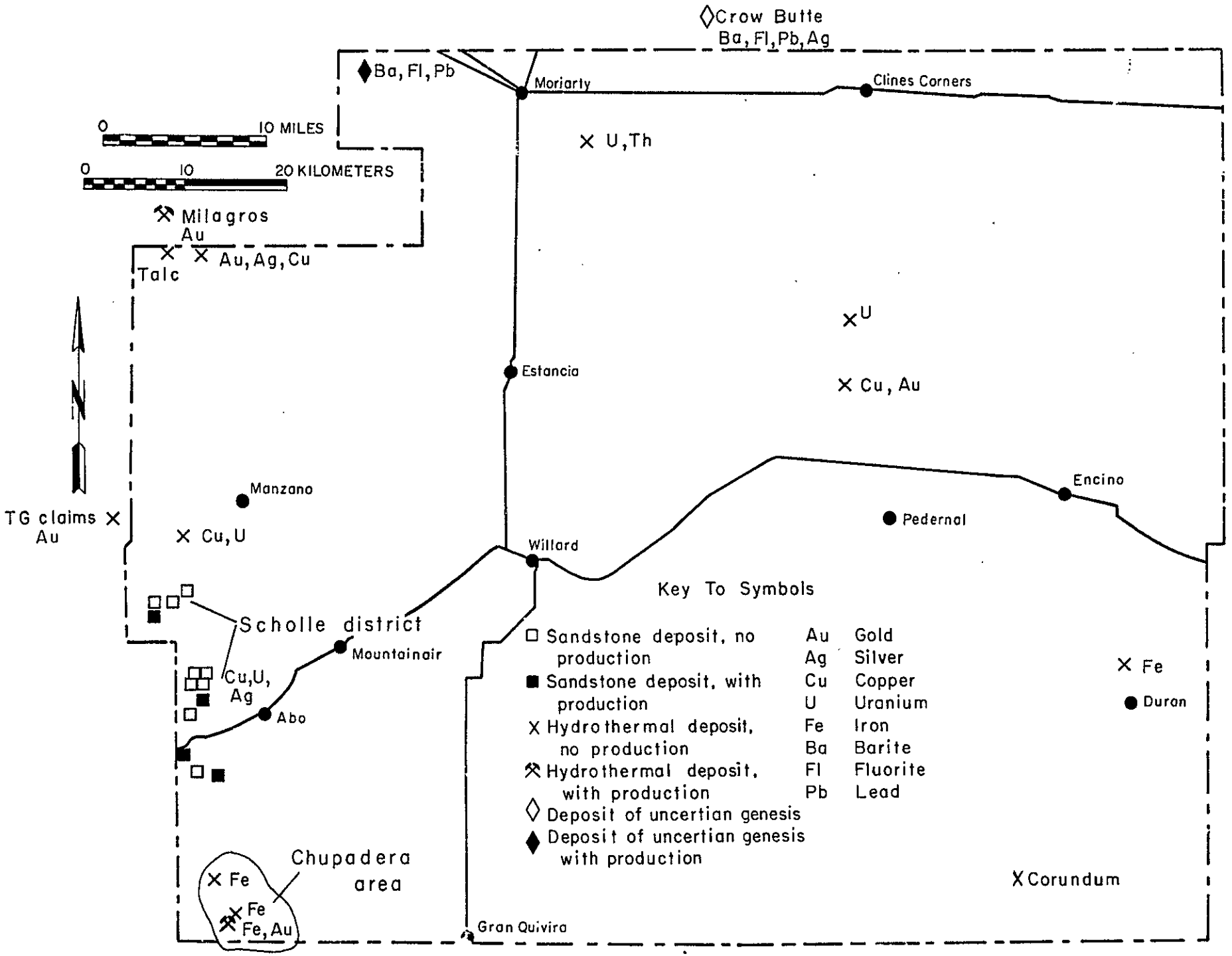
Deposit Types

Metallic mineralization occurs in stratabound, sedimentary copper deposits (red-bed deposits) and iron-replacemnt (contact metasomatic or hydrothermal) deposits (Figs. 10, 12, 13, 14, 15), although metal production from Torrance County has been insignificant. Favorable geologic environments plus minor metallic occurrences suggest potential mineral deposits may be concealed elsewhere in Torrance County, including: (1) gold (with or without copper) deposits in Precambrian greenstones, (2) Precambrian massive sulfide deposits, (3) Precambrian iron deposits, (4) sulfides deposits of unknown origin, and (5) silver and lead associated with barite-fluorite veins along faults in Paleozoic limestones and sandstones (Figs. 10-16).

Stratabound, sedimentary copper deposits

Copper mineralization with associated silver, gold, lead, uranium, and vanadium occurs in stratabound, sedimentary deposits in the Abo Formation in the Scholle district at the junction of Torrance, Socorro, and Valencia Counties (Figs. 11-13; Appendix 1). Minor occurrences of copper and local uranium mineralization also are found in sandstones of the upper Bursum and lower Yeso Formations in the Scholle district and in the Abo Formation in the Manzano Mountains north of the Scholle district (Figs. 10, 12; Appendix 1; McLemore, 1983a).

Figure 10 - Mineral occurrences in and near Torrance County (excluding materials pits).



Copper deposits were known in the Scholle district as early as 1904, but production of the deposits did not begin until 1915. Prospecting for uranium occurred during the 1950's after a local prospector discovered a thin seam that was assayed at 13% U_3O_8. From 1915 to 1961, total production from this district amounted to 15,037 tons (13,641 metric tons) of ore that contained 1,122,465 lbs (509,142 kg) of copper, 8,147 oz (230,992 g) of silver, 426 lbs (193 kg) of lead, and 9.96 oz (282 g) of gold that was worth more than $255,000 (Table 7). In addition, $700 worth of radium was mined in 1916 (U.S. Bureau of Mines files, 1949). Most of this production was from Torrance County. The district has not yielded any ore since 1961, although numerous active claims are located in the area (Table 5; Fig. 7; U.S Bureau of Mines files).

All of the known deposits occur at or near the surface and were mined by both surface and underground methods. The largest mines in the district are the Copper Girl and Abo. The depths to the deposits are relatively shallow (several tens of feet deep) and most of the ore produced was hand sorted before shipping. Several leach plants attempted unsuccessfully to recover the metals during the 1950's and 1960's.

Mineralization is restricted to the lower member of the Abo Formation, the upper member of the Bursum Formation, and the Meseta Blanca Sandstone Member of the Yeso Formation. Several horizons of copper and uranium mineralization are associated with bleaching of typically red arkoses and sandstones to pink or gray. Copper and uranium minerals in the Abo and Bursum Formations occur (1) as disseminations within bleached arkoses,

Table 7 - Mine production from Scholle district, Torrance, Socorro, and Valencia Counties (U.S. Geological Survey, 1915-1931; U.S. Bureau of Mines, 1932-1961).

Year	No. mines	Ore tons	Cu (lbs)	Cu ($)	Pb (lbs)	Pb ($)	Ag (oz)	Ag ($)	Au (oz)	Au ($)	Total $
1915	5	188	25,143	4,400			124	63			4,463
1916	13	3,172	331,475	81,543			2,600	1,711			83,254
1917	14	2,169	200,626	54,771	326	28	1,312	1,081	1.45	30	55,910
1918	7	637	78,757	19,453			361	361			19,814
1919	2	75	5,468	1,017			25	28			1,045
1920-1921	no production										
1922	1	16	1,740	235			13	13			248
1923	2	59	6,476	952			15	12			964
1924-1927	no production										
1928	7	1,943	187,083	23,940			1,952	1,142	8.22	171	25,253
1929	4	2,001	160,500	28,248			1,413	753			29,001
1930	2	120	9,000	1,170			57	22			1,192
1931-1932	no production										
1933	1	56	2,000	128			17	6	0.29	6	140
1934-1935	no production										
1936	1	25	1,500	138			5	4			142
1937	1	48	2,000	242			5	4			246
1938	see footnote 1										
1939-1942	no production										
1943	2	220	19,000	2,470			135	96			2,566
1944-1952	no production										
1953	1	192	6,400	1,837	100	13	13	12			1,862
1954	2	1,086	11,100	3,274			2	2			3,276
1955	no production										
1956	2	146	4,600	1,955			17	15			1,970
1957	2	2,876	69,500	20,919			81	73			20,992
1958-1960	no production										
1961	1	8	100	60							60
1962-1983	no production										
TOTAL		15,037	1,122,468	246,752	426	41	8,147	5,398	9.96	207	252,398

[1] In 1938, 47 tons yielding 4,700 lbs Cu, 405 oz Ag, and 14.2 oz Au were shipped from Scholle. However, this shipment is not included here because the Ag and Au contents are too high for the average red-bed sandstone deposit. It is possible that the shipment originated elsewhere than the Scholle district.

limestone-pebble conglomerates, and siltstones, (2) along bedding planes and fractures at or near sandstone-shale, sandstone-siltstone, and sandstone-limestone contacts, and (3) as replacements of wood and other organic materials. Copper oxides, chalcopyrite, and chalocite are the dominant copper minerals, whereas tyuyamunite, metatyuyamunite, carnotite, and uraninite are the dominant uranium minerals (Gibson, 1952; Collins and Nye, 1957). Selected samples were assayed to contain up to 14.37% Cu, 0.017% U_3O_8, 3.18 oz/ton (108 ppm) Ag, 0.05% Pb, and 0.05% Zn (Table 8). In addition, samples collected by Pierson and others (1982) contained up to 230 ppm Th, 920 ppm Co, and 1,300 ppm V (Table 9). LaPoint (1979) includes analyses of 60 samples from Scholle that contained up to 27% Cu, 100 ppm Ag, 200 ppm Pb, 123 ppm Zn, and 500 ppm V.

The larger deposits are associated with channel sandstones in the Abo Formation; only small occurrences are found in the Bursum Formation. The Abo deposits are low grade and discontinuous along outcrop. Several small, but scattered ore bodies are located in the subsurface near the Abo mining claims by drilling in meandering channel sandstones. However, none of these ore bodies were of economic grades during the 1950's (Collins and Nye, 1957).

Stratabound, sedimentary copper deposits occur in the Meseta Blanca Sandstone Member in the Rayo district, east of Chupadera in Socorro County and at the Gabaldon mine in Torrance County (Fig. 12; Appendix 1). The Meseta Blanca was deposited in brackish water or transgressive marine environments. Copper occurs in white to gray quartz sandstones and gray shales;

Table 8 - Chemical analyses of selected samples from the Scholle district, Torrance County. All chemical analyses by Lynn Brandvold and associates, New Mexico Bureau of Mines and Mineral Resources, chemical laboratory.

Location	Name	% Cu	% U_3O_8	Ag oz/ton[1] (ppm)	% Pb	% Zn
3N.5E.15.441	Pioneer mine[2]	4.18	0.002	0.56(19)	0.02	0.05
4N.5E.28.110	Copper Girl mine[2]	0.83	0.005	0.05(1.7)	0.02	0.02
3N.5E.23.111	Abo mining claims[2]	6.36	0.001	3.18(108)	0.05	0.02
3N.5E.23.111	Abo mining claims[2]	11.11	0.002	3.00(102)	0.02	0.01
2N.5E.4.214	Mill site[2, 3]	14.37	0.017	0.54(18)	0.03	--
2N.5E.13	Gabalon mine	1.2	0.001	0.54(18)	0.005	0.07
2N.5E.13	Gabalon mine	3.1	<0.001	0.98(33)	0.006	0.002
2N.5E.13	Gabalon mine	3.5	0.001	0.98(33)	0.004	0.001

1 - no gold was detected in any of these samples
2 - from McLemore, 1982 and 1983a
3 - in Socorro County

Table 9 - Chemical analyses of six samples from the Abo mining claims, Scholle district, Torrance County, New Mexico (Pierson and others, 1982). All analyses are in ppm.

	MDQ-155	MDQ-156	MDQ-157	MDQ-158	MDQ-159	MDQ-160
U	23.20	39.20	9.92	827.00	418.00	656.00
Th	<9.20	<12.00	25.10	<180.00	<170.00	<230.00
Ag	<1	2.1	<1	<1	16.0	9.9
Co	15	34	7.4	•7.3	920	240
Cr	63	52	18	20	40	20
Cu	720	3,400	6.6	7,700	>20,000	>20,000
Mo	<10	<10	<10	<10	12	<10
Ni	31	23	13	12	360	460
Pb	<10	<10	<10	<10	<10	200
V	91	110	80	170	570	1,300
Zn	54	<50	<50	<50	130	180

MDQ-155 - siltstone
MDQ-156 - siltstone
MDQ-157 - unmineralized limestone
MDQ-158 - limestone conglomerate
MDQ-159 - limestone conglomerate
MDQ-160 - limestone conglomerate
All samples from Abo Formation

uranium values are low (LaPoint, 1974; McLemore, 1983a). Copper analyses showed up to 3,000 ppm from subsurface sandstones in the Rayo area (LaPoint, 1979). LaPoint (1979) included chemical analyses of 14 samples from the Rayo district which include concentrations up to 12.4% Cu, 10 ppm Ag, 200 ppm Pb, 25 ppm Zn, and 100 ppm V. At the Gabaldon mine, disseminated chalcocite, malachite, and azurite occur in a well-sorted, quartz sandstone. Locally, the sandstone is cemented by copper mineralization. Organic material is absent in the sandstones. Select samples were assayed to contain up to 5.5% Cu, 0.001% U_3O, and 0.98 oz/ton (33 ppm) Ag (Table 8).

These stratabound ore deposits are typical of many "red-bed" copper deposits in New Mexico and elsewhere in the world (LaPoint, 1976, 1979). The erosion of pre-existing mineral deposits or of rocks high in copper, uranium, vanadium, silver, and gold from local Precambrian terranes in the Pedernal Hills and Manzano Mountains could have provided a source for the Scholle ore deposits (LaPoint, 1974; 1979; Fischer and Stewart, 1961). Some copper mineralization may have been emplaced as detritus in the sediments; however, most of the mineralization is a result of ground-water deposition. Copper was released from the clay and mafic minerals in the sediments and from the Precambrian terrane and was transported in permeable channel sands. Deposition occurred near organic material at the contact with H_2S-rich waters, near clay minerals, or when the solubility of copper and associated metals decreased due to an increase in pH (LaPoint, 1979).

The mineral-resource potential for copper, silver, gold, and

uranium deposits in the basal Abo Formation in the Scholle district is low to moderate (Figs. 18, 19). Although mineralization is known to occur in the area, these deposits are too small, discontinuous, low in grade, and widely scattered to be considered economic at the present time. Anomalously high uranium concentrations do occur in water samples in the immediate vicinity of the mineralized areas, but only weak anomalies occur down dip from these areas (Pierson and others, 1981). Only a few anomalously high uranium concentrations occur in stream-sediment samples in the area. Anomalously high tin, niobium, tungsten, silver, lithium, bismuth, and cobalt are found in stream-sediment samples from the Scholle area (Fig. 8) where mining claims have been located (Fig. 7). Should the market for uranium and copper improve, this area may warrant additional exploration; however, under current economic conditions, the potential for development is low.

The mineral-resource potential in the Bursum Formation in the Scholle district and in the Abo Formation in the Manzano Mountains north of the Scholle district is very low because economic ore bodies have yet to be proven (Figs. 18, 19). The mineral-resource potential for copper in the Meseta Blanca Sandstone Member in Torrance County is low to moderate (Figs. 18, 19). The potential for silver and uranium in this unit is very low. The extent and grade of the copper mineralization is unknown. Exploration of this unit for copper may be warranted if the copper market improves. The mineral-resource potential for copper in any of these units below depths of about 200 ft (60 m) is very low due to current economic conditions. The mineral-

resource potential of the Scholle ore with regard to fluxing ore is probably low because of the high feldspar content.

Stratabound, sedimentary copper deposits are known to occur in the Triassic Chinle Formation and Santa Rosa Sandstone elsewhere in New Mexico (McLemore, 1983a; Soulé, 1956). However, mineral occurrences have not been reported in these formations in Torrance County, although a few geochemical anomalies do occur in the vicinity of these formations (Fig. 8). These formations are thin or not present due to nondeposition or erosion in Torrance County. Therefore, the mineral-resource potential is presumed to be very low.

Iron-ore deposits

In 1903, the Blackington and Harris iron deposits were found near Chupadera on the Chupadera Mesa in southwest Torrance County (Figs. 10, 13). Additional deposits were discovered in the following years (Appendix 1). The Blackington and Harris claims were relocated in 1953 and named the L and H iron lodes (Harrer and Kelly, 1963). Iron was produced intermittently between 1964 and 1975, however, the total production is unknown. In 1964, 100 tons (91 metric tons) of iron ore worth $125 were produced (New Mexico State Inspector of Mines, 1965).

The ore deposits are small and of intermediate grade and occur adjacent to Tertiary dikes in Yeso sediments as replacement bodies. The largest known ore bodies are only 100 ft (30 m) long and 5 ft (2 m) wide. Thickness of the ore deposits is unknown. Two select samples each ranged from 39.6 to 47% total iron and

each contained 0.02 oz/ton Au (0.7 ppm) (Table 10). The Chupadera iron deposits are smaller and lower in grade than the iron deposits at Jones Camp in Socorro County, but they are similar in composition and emplacement. These ore bodies are possibly contact-metasomatic or hydrothermal and formed during emplacement or cooling of the dikes. However, Gibbons (1981) suggests that the Jones Camp deposits were formed by low-temperature leaching of the dikes followed by precipitation in the sediments.

Iron-ore deposits occur in sandstones of the Yeso Formation near Duran (Figs. 10, 15; Appendix 1). The Garner shaft was sunk in the area and a dump sample contained 47.94% total iron (Table 10). A Tertiary sill intrudes the Yeso sediments in the vicinity (Kelley, 1972) and may have controled mineralization as it did with the Chupadera deposits.

The mineral-resource potentials for the Chupadera and Duran iron ore deposits are low (Figs. 19, 21). The grades of known deposits are low and there are no geochemical anomalies present in the HSSR data (Fig. 8) or magnetic highs (Fig. 23) to indicate additional ore. Iron ore is used in New Mexico as an aggregate for road construction and cement because there are presently no steel mills operating in the state. However, if a steel mill should be built in central New Mexico, the Chupadera iron deposits could have a higher mineral-resource potential.

Table 10 - Chemical analyses of iron samples from the Chupadera and Garner deposits in Torrance County. Analyses by Lynn Brandvold and associates.

	Total Iron %	Au oz/ton	Ag oz/ton	Mn %	SiO_2 %	P_2O_5 %	CaO %	MgO %	TiO_2 %	Cu ppm	Zn ppm	Co ppm	Ni ppm	Cr ppm
T-83-5	39.6	0.02	0.00	0.12	1.70	0.33	24.59	1.34	0.20	345	20	257	76	17
T-83-6	47.0	0.02	0.00	0.03	1.75	0.19	19.22	1.33	0.24	560	20	109	138	13
T-83-16	14.50	trace	0.00	-	83.83	-	0.56	0.02	0.21	50	55	-	-	-
T-83-17	12.00	trace	0.00	-	85.13	-	1.26	0.02	0.27	56	11	-	-	-
T-83-15	47.94	trace	0.00	-	47.62	-	0.21	0.65	0.69	82	198	-	-	-

T-83-5 -- Chupadera mine (1N.6E.29.333)
T-83-6 -- Geoslim pit (1N.6E.31.222)
T-83-16 -- near Garner mine, outcrop on mesa (3N.15E.17.244)
T-83-15 -- Garner mine, mine dump sample (3N.15E.17.421)

Miscellaneous

Favorable geologic environments occur in Torrance County that are analogous to environments elsewhere in the world known to contain ore deposits. Some of these deposits include: (1) gold in Precambrian greenstones (with or without copper); (2) Precambrian massive sulfide deposits; (3) Precambrian iron deposits; (4) sulfide deposits of unknown origin; and (5) lead and silver associated with barite-fluorite veins in Paleozoic limestones and sandstones. Although economic mineral deposits are not known to occur in these environments in Torrance County, various geologic criteria, reported mineral occurrences, and geochemical anomalies suggest potential mineral deposits could be concealed in these environments.

Precambrian greenstone terranes consisting of dominantly metamorphosed, mafic, volcanic sequences contain many of the world's primary gold deposits (Anhaeusser and others, 1969). Some of these ore deposits may be syngenetic, and they probably formed by hot brines contemporaneously with submarine volcanism. Subsequent hydrothermal activity or metamorphism associated with younger granitic intrusives may have redistributed and concentrated gold from primary gold deposits or gold-enriched volcanic rocks to form deposits in stratabound horizons, veins, shear zones, or saddle reefs. Copper mineralization may or may not be associated with these deposits.

Volcanogenic massive sulfide deposits also are associated with Precambrian greenstone terranes. These polymetallic, stratabound deposits formed contemporaneously with submarine volcanism by hot saline brines, similar to gold deposits in

greenstones (Giles, 1976; Riesmeyer and Robertson, 1979). Variable amounts of sphalerite, galena, chalcopyrite, magnetite, molybdenum, and gold occur as concordant bodies within metavolcanic and metasedimentary rocks. Primary sedimentary structures are preserved locally and widespread alteration is absent.

Gold occurs in New Mexico's Precambrian greenstones in the Tijeras Canyon and Hell Canyon districts in the Sandia, Manzanita, and Manzano Mountains (Fulp and Woodward, 1981). The Hell Canyon district is only a few miles north of the Valencia-Torrance county line (Figs. 10, 11) and the largest known deposit, the Milagros, yielded 2,348 oz (66,565 g) of gold and 9,333 oz (264,586 g) of silver that were recovered by heap leaching in 1975 and 1976 (Woodward and others, 1978). Copper, gold, and silver occurs in lenticular quartz veins emplaced along shear zones in the greenstones (Kelley and Northrop, 1975; Woodward and others, 1978; Fulp and Woodward, 1981). Gold-bearing quartz veins partially replaced the greenstones and cemented brecciated, early-formed quartz.

A polymetallic, volcanogenic sulfide deposit occurs in the Tijeras Canyon district at the York mine (Fig. 11; Fulp and Woodward, 1981; Kelley and Northrop, 1975). The York deposit is a small, stratiform copper-lead-zinc ore body in a marble lens within greenstone (Kelley and Northrop, 1975; Fulp and others, 1982). This greenstone is similar to the greenstone exposed at the Milagros mine and in northern Torrance County.

South of the Milagros mine in northwestern Torrance County,

copper occurrences in greenstones, especially along shear zones, are common (Edwards, 1978). One mineralized sample of this greenstone was assayed to contain 540 ppm Cu, 0.035 oz/ton (1.2 ppm) Ag, and 0.001 oz/ton (0.034 ppm) Au (Appendix 1; Fig. 10; Edwards, 1978). Bismuth and cobalt geochemical anomalies (possible pathfinder elements for gold deposits) occur in NURE stream-sediment samples from this area (Fig. 8), which further suggests that gold and polymetallic mineralization may be concealed in this area.

The mineral-resource potential for gold and silver veins in the greenstone terrane in the northern Manzano Mountains is moderate (Fig. 18). The mineral-resource potential for massive sulfides deposits is unknown. Although copper mineralization, gold mineralization, and silver mineralization are known to occur, economic ore bodies have yet to be found. The potential for development is moderate, however, most of the favorable greenstones lie on the Isleta Indian Reservation. The subsurface projection of these greenstones is unknown.

Greenstone terranes consisting of interbedded, mafic, volcanic and sedimentary rocks occur in the Pedernal Hills and are similar to the greenstones in the Hell Canyon and Tijeras Canyon districts (Condie and Budding, 1979; Fulp and Woodward, 1981). Copper mineralization is found in these greenstones, although no chemical analyses are available (Jeremy Setter, KRITI Exploration, Inc., personal communication, 1983; Fulp and Woodward, 1981). Lead and silver geochemical anomalies in stream sediments are found in the area (Fig. 8) and may be pathfinder elements for gold or polymetallic mineralization.

The mineral-resource potential for gold, silver, and massive sulfides deposits in the Precambrian greenstone terranes in the Pedernal Hills is unknown (Fig. 21). Although copper, gold, silver, and lead mineralization are known to occur, economic ore bodies have yet to be found even though mining claims have been located in the Pedernal Hills (Fig. 7). Detailed geologic mapping and geochemical studies are required to adequately assess the mineral-resource potential in these areas. If concealed mineral deposits do occur in the greenstones in the Pedernal Hills, the potential for development would depend on the grade of the ore deposits. Much of the favorable land containing greenstones in the Pedernal Hills is privately owned. However, the federal and state governments do own some of the mineral rights.

Precambrian iron formations constitute a large percentage of the world's iron resources (Anhaeusser and others, 1969). Most iron formations formed as a chemical precipitate, although some of the deposits may have been enriched by secondary processes. In Torrance County thin lenses, veins, and fracture fillings of specular hematite occur within Precambrian quartzite and quartz-schist sequences in the Manzano Mountains and Pedernal Hills (Condie and Budding, 1979). Quartz-specularite schists contain 20-30% specularite and 2% magnetite in the Pedernal Hills. The iron-rich layers average 4 mm thick and occur in zones 10 mm thick (Woodward and Fitzsimmons, 1967; Gonzalez, 1968; Gonzalez and Woodward, 1972). Thin, irregular streaks and lenses of specular hematite are common in Precambrian quartz reefs in the

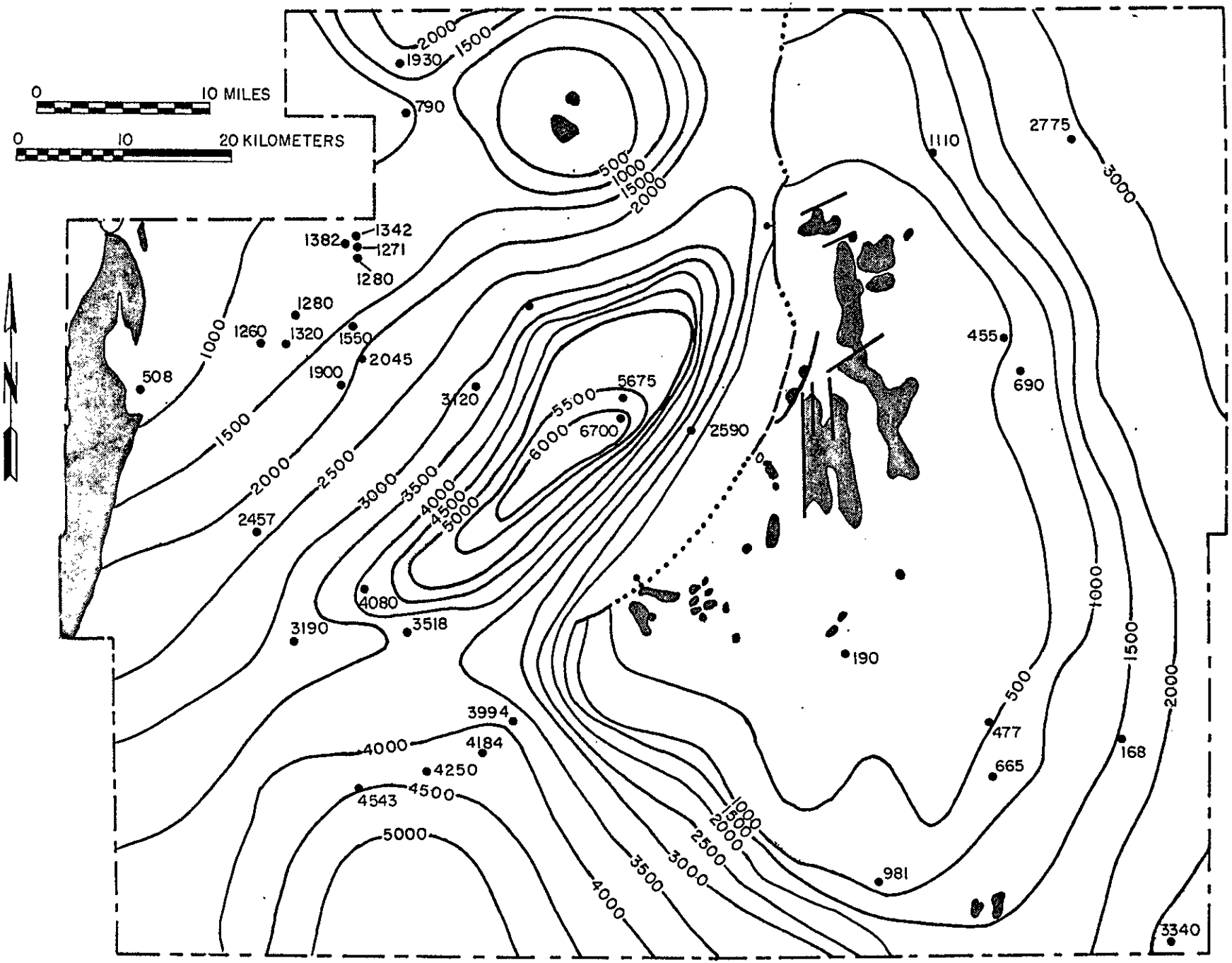
Manzano Mountains (Stark, 1956). Although iron-rich zones are continuous along strike in the Pedernal Hills and Manzano Mountains, these deposits are too small, too low grade, and too inaccessible to constitute an economic resource. The mineral-resource potential is therefore very low.

Numerous occurrences of metallic mineralization of undetermined economic significance are found in Precambrian rocks throughout New Mexico (Fulp and Woodward, 1981). Most of these occurrences appear to be small and low grade, although any of the gold-bearing veins or shears could have economic potential. The origin and age of these occurrences are uncertain.

The Berry mine in the Pedernal Hills (Figs. 10, 15; Appendix 1) is an example of such an occurrence. Chalcocite and copper oxides possibly with associated silver and gold occur along a fault zone within the Pedernal granite (Precambrian). An unmineralized sample of this granite near the Berry mine contained <500 ppm Cu, 200 ppm Fl, and 2 ppm U (Jeremy Setter, personal communication 1983). Mining claims have been located in the vicinity (Fig. 7) and this area has potential for hydrothermal copper and uranium mineralization or possibly may indicate a porphyry-type copper deposit of Precambrian age.

The mineral-resource potential for copper, gold, silver, and uranium along fault zones within the Pedernal granite are unknown because chemical analyses are not available from these occurrences (Fig. 21). There is not enough information available about these occurrences to adequately assess the mineral-resource potentials. Much of the Precambrian terrane is covered by a thin section of sediments (Fig. 24). Wherever the Precambrian terrane

Figure 24 – Depth to Precambrian rocks in Torrance County, New Mexico



is shallow enough to be considered an economic target (depending on size and grade anywhere from 500 to 2,000 ft; 152 to 610 m deep), these rocks also have unknown mineral-resource potential.

Several prospects occur along faults in the Precambrian metasedimentary rocks in the Manzano Mountains in Valencia and Torrance Counties (Figs. 10, 12; Maxwell and Wobus, 1982a, b; Maxwell and Light, 1984). One sample from the TG claims was assayed to contain 0.37 oz/ton (12.6 ppm) Au, 4.0 (136 ppm) oz/ton Ag, 0.65% Cu, and 1.45% Pb (Maxwell and Light, 1984). Samples collected by the author and Robert North ranged in concentration from 0 to 0.36 oz/ton (12.6 ppm) Ag, 60 to 270 ppm Cu, <0.01 to 3.68% Pb, and 0.002 to 0.014% Zn; gold content was below the detection limit (0.07 ppm). Anomalously high values of Au, Ba, Cr, Pb, and Cu were found in stream sediment samples collected by Maxwell and Wobus (1982b) from Comanche Canyon, Canon del Trigo, and the southwestern part of the Manzano Wilderness (Fig. 9). Additional geochemical anomalies of Cr, Ni, Pb, and Co were found in the HSSR samples from streams draining from the Manzano Mountains (Fig. 8). These areas certainly warrant further study.

Maxwell and Light (1984) classified the mineral-resource potential for gold in the southern portion of the Manzano Wilderness as probable or low to moderate (Fig. 26). However, the mineral-resource potentials for gold and other metals in the metamorphic rocks elsewhere in the Manzano Mountains are unknown (Figs. 25, 26).

Thin quartz veins occur in the Precambrian metamorphic rocks near the carbonatite dike and syenite outcrop at Lobo Hill (Fig.

15, Appendix 1). A sample of a quartz vein was assayed to contain 0.06 oz/ton (2 ppm) Ag and a trace (less than 0.7 ppm) of gold. Silver anomalies in the HSSR data also occur in the vicinity of Lobo Hill (Fig. 8). The mineral-resource potential for silver veins in the Precambrian rocks at Lobo Hill is unknown (Fig. 21) and a classification would have to include the surrounding area where the depth to the Precambrian surface is shallow (less than 500 ft; 152 m; Fig. 24).

Lead occurs in barite-fluorite veins in limestones of the Madera Group in northwestern Torrance County (Appendix 1; Figs. 10, 11) and in limestones and sandstones of the Yeso Formation at El Cuervo in southeastern Santa Fe County (Figs. 10, 16). Barite and fluorite with minor galena and silver occur in veins along faults and fractures. Although these veins dominantly contain barite, lead-zinc veins could be in the vicinity. A cluster of lead, zinc, and barium geochemical anomalies in the NURE stream sediments occurs in the vicinity of El Cuervo (Fig. 8) which suggests the presence of concealed deposits in the area. Geochemical anomalies in the Manzano Wilderness study (Fig. 9; Maxwell and Wobus, 1982b) could suggest similar vein mineralization in the Madera Group along the eastern ridges of the Manzano Mountains. Other structure-controlled deposits of lead and lead-zinc veins are found at the Magdalena and Bingham districts in Socorro County (North, 1983; Putnam and others, 1983). These deposits are discussed in greater detail in the next section.

Deposit types

Nonmetallic minerals and other commodities include industrial rocks and minerals as well as other commodities for specific uses. Limestone and sand and gravel, used as aggregate are major commodities in Torrance County, although salt, barite, and, more recently, adobe materials have been produced. Large resources of undeveloped gypsum occur in Torrance County and minor occurrences of uneconomic fluorite, talc, sulfur, and high-silica quartzites also are found.

Barite and fluorite deposits

Barite and fluorite veins (with associated lead and silver) are found along fault zones in limestones of the Madera Group in northwestern Torrance County and in limestones and sandstones of the Yeso Formation at El Cuervo Butte in southeastern Santa Fe County (Figs 10, 11, 22; Appendix 1; Williams and others, 1964). In 1956, 50 tons (45 metric tons) of barite worth $250 were shipped from the Shockley deposit in Torrance County (New Mexico State Inspector of Mines, 1956). No other production is known.

Coarsely crystalline barite and fluorite with minor galena occur in veins up to 4 ft (1.2 m) wide at the Shockley and Tina prospects in northwestern Torrance County. The Shockley deposit can be traced for 1,500 ft (457 m; Williams and others, 1964); two select chip samples were taken by Williams and others (1964). One was assayed to contain 90.5% $BaSO_4$ and the other 20.7% CaF_2. Select samples (collected by Tom Smith, NMBM&MR) were assayed to

contain up to 76.72% $BaSO_4$, 0.74% Pb, and 0.20 oz/ton (7 ppm) Ag (Table 11). The barite is mostly opaque and white, whereas the fluorite is clear to translucent and white to pale green. Galena is also common. The 1-ft-thick (0.3-m) veins are along fault and brecciated zones within the Madera Group and are similar to many barite occurrences throughout central New Mexico (T. J. Smith, 1982; Williams and others, 1964; Williams, 1966; Rothrock and others, 1946).

The deposits at El Cuervo Butte in southern Santa Fe County (Figs. 10, 16) occur along a major fault between the Yeso and Chinle Formations. Barite veins up to one foot (0.3 m) wide occur in a zone 3 to 5 ft (1 to 2 m) wide and almost 2.5 mi (4 km) long. The veins consist mostly of barite, although fluorite, galena, and silver are present locally. Chemical analyses showed that the deposits contain up to 85.93% $BaSO_4$, 2.31% Pb, and 0.22 oz/ton (8 ppm) Ag (Table 11).

Anomalous geochemical values of lead and barium occur in the NURE stream-sediment samples west of the El Cuervo deposits and along the Manzano Mountains (Fig. 8). These anomalies may indicate additional concealed barite-lead-silver veins in southern Santa Fe and northern Torrance Counties and in the Manzano Mountains.

The mineral-resource potential for barite and fluorite in northwestern Torrance County is low (Fig. 17). The extent and quantity of these deposits are not well known, but they are not expected to be large enough to be mined economically. There are no geochemical anomalies in the area except for lithium (Fig. 8).

Table 11 - Chemical analyses of barite samples from the Shockley deposit, Torrance County and the El Cuervo deposit, Santa Fe County. Analyses by Lynn Brandvold and associates, 1984.

	$BaSO_4$%	CaF_2%	$CaCO_3$%	Pb%	Zn%	Cu (ppm)	Ag oz/ton (ppm)
Shockley	67.72	16.46	0.97	0.74	0.01	167	0.20 (7)
Shockley	66.67	13.07	3.02	0.34	0.11	115	0.08 (3)
Shockley	76.72	-	-	0.03	0.0004	72	-
El Cuervo South, sec. 16	87.77	-	-	0.008	0.0002	12	-
El Cuervo, sec. 16	0.11	-	-	0.006	0.005	-	0.20 (7)
El Cuervo North, sec. 16	85.93	-	-	0.003	0.0004	6	-
El Cuervo, sec. 21	27.28	-	-	2.31	0.01	-	0.22 (8)

If economic deposits exist the potential for development is low because the area is in the middle of a planned residential subdivision (Dianna Normand; written communication 1982).

The mineral-resource potential for barite and fluorite in north-central Torrance County near Moriarty is unknown (Fig. 21). In the NURE geochemical data anomalous concentrations (Fig. 8) suggest additional deposits could occur in the vicinity. The mineral-resource potential in the Madera Group along the Manzano Mountains is unknown.

Aggregate and dimension stone

Aggregate resources are any rock material that can be used as riprap, ballast, subbase, fill, or additives to cement or asphalt to form concrete. Aggregate production for constructing highways and railroads accounts for the majority of the mineral production in Torrance County (Table 12). Most of the materials pits in Torrance County are listed in Appendix 1 and shown in Figures 11-16, however, some of the older or newer pits may have been overlooked. The proper selection of a potential site for aggregate material depends on the final product desired, haulage distance, and quality and quantity of available materials. Geologic units favorable for aggregate resources are shown in Figures 26-31.

The American Society for Testing and Materials (ASTM) has established criteria by which the quality of aggregate resources can be measured. The plasticity index is a measure of the clay content and should be zero or very low. Materials with a high plasticity index absorb large amounts of water and undergo large

Table 12 - Ballast, stone, sand and gravel production in Torrance County (U.S. Bureau of Mines, 1954-1981)

Year	Tons	Value (dollars)
1954	W	53,209
1955	0	0
1956	656,900	571,000
1957	538,000	672,000
1958	473,500	561,640
1959	649,648	663,864
1960	94,000	111,200
1961	62,000	75,000
1962	W	W
1963	0	0
1964	0	0
1965	287,000	172,000
1966	328,028	212,042
1967	59,000	59,000
1968	352,000	216,000
1969	312,000	392,000
1970	W	W
1971	W	W
1972	10,000	11,000
1973	48,000	61,000
1974	63,000	43,000
1975	93,000	133,000
1976	W	204,000
1977	W	163,000
1978	W	124,000
1979	W	124,000
1980	W	13,000
	Total (excluding withheld values)	4,634,955

W = Withheld

volume changes. Los Angeles Wear is a measure of the aggregate's resistance to abrasion. Soundness Loss is a measure of the resistance to weathering. The New Mexico State Highway Department Staff (1975) has evaluated many of the materials pits in Torrance County and the results are included in Appendix 1.

The most common materials for aggregate use in Torrance County are sand, gravel, dimension stone, limestone, and iron deposits. Limestones and dolomites are abundant in the Madera Group and in the Bursum, Yeso, and San Andres Formations; these will be discussed separately. Iron deposits or iron-rich sediments occur in the Yeso Formation and were discussed previously under the section entitled Metals. Sand can be obtained from most surficial units, especially Quaternary pediment, stream, and other surficial deposits (Figs. 26-31). High-quality gravel sources in Torrance County are found in alluvial fans and pediment deposits adjacent to the Manzano Mountains, in beach deposits in the Estancia Valley, and in caliche in eastern Torrance County. The best aggregate resources are found in unlimited quantities in western Torrance County.

Special problems with aggregate resources occur in Torrance County because water for washing gravels is scarce and suitable aggregate materials are deficient in the widespread Yeso Formation because of high plasticity and high solubility. Furthermore, good quality aggregate resources are rare in eastern Torrance County.

Dimension or building stone can be obtained from Precambrian quartzite (Budding and Hartman, 1963) and the limestones in the Madera Group and San Andres Formation in western Torrance County.

Currently, the Blue Springs quarry near Abo Pass in Socorro County (Fig. 12) is supplying stone (quartzite and schist) to the Rocky Mountain Stone Co. in Albuquerque. Precambrian quartzite suitable for dimension stone occurs in the Pedernal and Lobo Hills; however, production has been limited because of remoteness from potential markets. In eastern Torrance County, dimension stone is rare; however, some caliche deposits of the Ogallala Formation or Quaternary deposits may be suitable for small projects and maintenance supplies.

The mineral-resource potential for aggregate in the Madera Group, in the Bursum, Yeso, and San Andres Formations, and in Quaternary pediment, alluvial-fan, beach, and stream deposits is high in western Torrance County (Figs. 26-28). The mineral-resource potential in Quaternary deposits and the Ogallala Formation in eastern Torrance County is moderate (Fig. 29-31). The potential for development of aggregate resources in Torrance County currently depends on road construction and maintenance.

Limestone and dolomite

Limestone and dolomite are sedimentary rocks composed of calcium and magnesium carbonate ($CaCO_3$ and $MgCO_3$). Low-calcium limestones (less than 95% $CaCO_3$) are used as crushed stone for aggregate, road metal, ballast, stucco, a soil conditioner, and dimension or building stone. High-calcium limestones (greater than 95% $CaCO_3$) are used as sources for lime, chemical raw material, portland cement, and metallurgical flux. Dolomite is used as crushed stone, dimension stone, and in various chemical

products (Siemers, 1982; Kottlowski, 1962, 1965a). In Torrance County, limestone and possibly dolomite have been quarried from the San Andres and Yeso Formations and from the Madera Group for crushed stone and dimension stone.

Limestones are abundant in the Madera Group and in the Bursum, Yeso, and San Andres Formations throughout Torrance County (Figs. 26-31; Siemers, 1982; Kottlowski, 1962, 1965a). Dolomite is rarely found in the San Andres Formation in Torrance County. In the Manzano Mountains (Figs. 26 and 27), limestone beds that are more than 50 ft (15 m) thick are common and have Los Angeles Wear and Soundness Loss values indicating they are excellent for road-building purposes (Appendix 1; New Mexico State Highway Department, 1975). In southwest and central Torrance County, including Chupadera Mesa (Fig. 28), limestone beds in the San Andres Formation are less than 50 ft (15 m) thick, but they are adequate for road building; the Los Angeles Wear and Soundness Loss values indicate they are good to excellent for road-building purpose (Appendix 1; New Mexico State Highway Department, 1975). In eastern Torrance County (Figs. 29-31), limestones are found in the Yeso Formation. These limestones are variable in quality, thickness, continuity, Los Angeles Wear values, and Soundness Loss values and they are not as desirable as San Andres or Madera limestones. However, Yeso limestones in eastern Torrance County are the best available local source (New Mexico State Highway Department, 1975; Kottlowski, 1962, 1965a).

High-calcium limestones are not as common. In the Sandia-Manzanita-Manzano Mountains, Madera limestones contain 92 to 96%

Table 13 - Chemical analyses of limestones from the Madera Group in Abo Canyon area.

	1	2	3	4	5	6	7	8
CaO	52.18		54.15	55.33	52.50	53.65	54.64	51.26
MgO	0.69		0.68	0.46	0.66	0.03	0.20	0.46
SiO_2	4.57	4.78	1.92	0.69	2.52	2.80	0.29	0.52
Al_2O_3	0.59	0.49	0.64	0.19	0.83	0.64	0.15	0.79
Fe_2O_3	0.52	0.39	0.29	0.23	0.34	0.33	0.33	0.33
P_2O_5	0.024	0.049	<0.05	<0.05	<0.05	<0.5	<0.5	0.13
CO_2	41.33	41.20	41.99	42.7	41.84	42.03	42.19	40.00
S	0.015	0.015	---	---	---	---	---	---
$CaCO_3$	93.14	92.50	93.90	96.02	93.98	94.10	96.92	96.05
$MgCO_3$	1.44	1.30	1.30	1.01	1.21	1.14	0.49	0.66

1 - from Kottlowski (1962, #22)
2 - from Kottlowski (1962, #23)
3 - from Mark Logsdon (notes, 5/81, #PM-AP-1a)
4 - from Mark Logsdon (notes, 5/81, #PM-AP-1b)
5 - from Mark Logsdon (notes, 5/81, #PM-AP-1c)
6 - from Mark Logsdon (notes, 5/81, #PM-AP-3a)
7 - from Mark Logsdon (notes, 5/81, #PM-AP-3b)
8 - from Mark Logsdon (notes, 5/81, #PM-AP-3c)

$CaCO_3$ (Table 13; Kottlowski, 1962). Elsewhere the limestones are lower in calcium content.

The mineral-resource potential for limestones in the Madera Group and in the San Andres, Yeso, and Bursum Formations in Torrance County (Figs. 26-28) is high. The mineral-resource potential for high-calcium limestones in the Madera Group in the Manzano Mountains is moderate (Fig. 26-28). The mineral-resource potential for pure dolomite is unknown because these rocks have not been delineated in Torrance County.

Limestones, like most industrial minerals, are a low bulk-value commodity and mines or quarries must be relatively close to markets. The potential for development of limestones in Torrance County depends largely on road construction. The potential for development of high-calcium limestones in Torrance County is low. If residential construction increases in the Rio Grande Valley south of Belen, a market for construction materials will develop and may warrant the operation of a cement plant. However, there are no plans for such development at present.

Gypsum

Gypsum ($CaSO_4 \cdot 2H_2O$) and anhydrite ($CaSO_4$) are similar industrial minerals with a variety of uses. Large quantities of gypsum occur at or near the surface in the San Andres and Yeso Formations throughout Torrance County (Figs. 26-31; Weber and Kottlowski, 1959; Weber, 1965; Hunter and Ingersoll, 1981; Logsdon, 1982b) although gypsum has never been produced from the area. At Abo Pass, gypsum beds 5-6 ft (1.5-1.8 m) thick occur in the Yeso Formation and thin beds of gypsum occur in the San

Andres Formation at Chupudera Mesa. Below the San Andres Formation, 23% of the Yeso Formation is gypsum. Near Willard, beds of inpure Yeso gypsum are up to 100 ft (30 m) thick. In the lower Yeso, thinner beds of good quality gypsum occur.

Gypsum also occurs in small dunefields around the Estancia, Encino, and Pinos Wells playa lakes (Figs. 29, 30). The dunes are 50-100 ft (15-30 m) high and locally contain 77 to 80% gypsum (Table 14; Weber and Kottlowski, 1959). Much of this gypsum is suitable for agricultural purposes and could be mined if a market for it developed (Logsdon, 1982b; Weber, 1965).

Gypsum is used in the manufacture of construction materials, as a soil additives in agriculture, and in industrial chemicals. In New Mexico, gypsum is presently mined from the Todilto Formation (Jurassic) and has been mined from other formations in the past (Weber, 1965). Gypsum, like most industrial minerals, is a low bulk value commodity. Presently, crushed gypsum at the mine site in New Mexico is worth $.10 to $2.00/ton. Transportation costs add $1.00 per mile per truck carrying up to 30 tons (George Austin, personal communication, 1983); therefore, gypsum plants tend to be close to the mines as well as the markets. In New Mexico, all three active gypsum plants are within 30 or 40 miles (48 to 64 km) of Albuquerque where gypsum reserves in the Todilto Formation are hundreds of millions of tons (Logsdon, 1982b). Therefore, despite a high mineral-resource potential for gypsum in Torrance County (Hunter and Ingersoll, 1981), the potential for development is very low to nonexistant. The gypsum resources in Torrance County are too

Table 14 - Chemical analyses of gypsum from Torrance County, New Mexico (Weber and Kottlowski, 1959).

	232-G1	254-G1	254-G2
CaO	33.55	28.33	27.46
SO_3	45.16	38.42	37.74
H_2O	18.16	16.21	13.52
$Fe_2O_3 + Al_2O_3$	0.25	1.18	0.70
SiO_2	0.57	13.98	19.48
MgO	0.36	0.73	0.23
CO_2	2.16	1.87	1.25
TOTAL	100.21	100.72	100.38
$CaSO_4$	76.9	65.3	64.1
Gypsum	94.8	80.9	77.4

232-G1 - San Andres Formation, 5N.16E.34
254-G1 - Quaternary dune field, 3N.13E.13.300
254-G2 - Quaternary dune field, 3N.13E.14.400

far from major population centers in New Mexico to be considered a potential resource at the present time. However, the occurrence of limestone and gypsum in the Abo Pass area near Highway 60 and the railroad makes this a favorable region for a cement plant if a nearby market should develop (Kottlowski, 1962).

Adobe

The word adobe means brick and adobe has been used for construction in the southwest for centuries. Today, the use of adobe has resulted in a unique architecture which is popular in New Mexico and elsewhere in the country. New Mexico produces more adobe than any other state with about 48 active plants in 1980 (E. W. Smith, 1981, 1982a, b). A small producer of traditional, unstabilized adobe manufactured about 5,000 bricks in 1980 in Mountainair, Torrance County (E. W. Smith, 1982b).

Adobe material is found in Quaternary stream-channel, floodplain, terrace, eolian, and alluvial-fan deposits in central Torrance County (Figs. 26-31). Varying proportions of sand, silt, and clay can be used to manufacture adobe bricks; however, a proper balance of clay, silt, and sand (about equal parts) is needed to ensure a good quality brick. Clay mineral composition also affects the quality of the brick (E. W. Smith, 1982a, b). Nonexpansive clay minerals, particularly the kaolinite group, tend to form more brittle bricks than equal amounts of expansive clays (smectite group). However, expansive clays are needed to provide compressive strength. An abundance of expansive clays will make poor bricks that will expand and crack. Therefore,

soils with a high percentage of nonexpansive clays and some expansive clays should produce a good quality brick.

The mineral-resource potential of adobe is high. A large quantity of good quality adobe material occurs in Torrance County, especially near Mountainair. However, adobe manufacture depends on a healthy construction industry as well as close proximity to a market. Although Mountainair is near the center of the state, competitors tend to set up manufacturing operations close to populated areas. Therefore, the potential for large-scale development of adobe is moderate unless a greater demand for adobe develops, especially in Torrance County.

Clay

Clay materials are used for a number of purposes, including adobe bricks, such as, manufacture of tile, brick, sewer pipe, and portland cement, fire clay, and pottery clay (Patterson and Holmes, 1965). Occurrence of speciality clays such as bentonite, kaolin, and refractory clays, has not been reported in Torrance County. Bentonite occurs in rocks ranging in age from Permian to Quaternary in New Mexico (Patterson and Holmes, 1965; Talmage and Wootton, 1937) but the mineral-resource potential in Torrance County is unknown. Kaolin and refractory clays occur in rocks ranging in age from Pennsylvanian to Recent (Patterson and Holmes, 1965) in New Mexico but, again, the mineral-resource potential in Torrance County is unknown.

Common clays and shales are mined throughout New Mexico and are used to manufacture tile, brick, sewer pipe, and portland

cement. One clay pit is in Bernalillo County, just north of the Torrance County line. Clay is mined from the Madera Group in Bernalillo County for both brick manufacture and portland cement. The mineral-resource potential of common clay and shales in the Madera Group (Figs. 26-28) is moderate to high and the potential for development is moderate.

Salt (halite)

Numerous playa lakes in the Estancia, Encino, and Pinos Wells Basins furnish a residue of halite as a result of evaporation of lake water (Figs. 10, 27, 28, 30). The playa lakes in the Estancia Basin are the largest in Torrance County and cover approximately 13,500 acres (Meinzer, 1912). They range in size from a few acres to the Laguna del Perro (Dog Lake) which is more than 12 mi (19 km) long (Talmage and Wootton, 1937). Halite is the major mineral present in the lakes, although sodium sulfates and magnesium sulfates have been reported (Alto and others, 1965; Northrop, 1959; Talmage and Wootton, 1937, Phalen, 1919).

Spanish explorers found these deposits as early as 1581 when Rodriguez and Chamuscado visited this area. Numerous military escorts were provided by the Spanish to the lakes. Undoubtedly, however, Indians mined salt before the Spanish. As early as 1660, salt was being shipped 700 mi (1,100 km) from the Estancia Basin to the silver mines in Chihuahua, Mexico (Northrop, 1959, p. 276). The first modern commercial venture was established in 1915 by Julius Meyer. From 1915 to 1933, numerous proprietors owned and operated the company (Talmage and Wootton, 1937). The

New Mexico Salt Co. produced and marketed 350 tons (318 metric tons) of salt in 1932 and 700 tons (635 metric tons) in 1933 (Talmage and Wootton, 1937); no other production data are available.

The salt basins are distinct, flat-bottomed basins below the plain level, with no surface outlet. The salt floor typically coincides with the ground-water level and consists of mud and a thin crust of salt. The thickest salt deposits occur in Laguna Salina (Talmage and Wootton, 1937). The floor may be submerged under water after heavy rains. Wind deposited clay hills surround the salt basins. Wind excavated the basins down to the water level and formed these adjacent hills (Meinzer, 1912; R. E. Smith, 1957).

The halite varies in purity and in the 1930's it was sold as crude in three separate grades: 85, 92, and 98% pure. Vats formed by a low dike on the lake floor controlled deposition of the salt. A well was sunk near one end of the dike where water was pumped and allowed to accumulate in the vats. By this method, a better quality of salt could be mined (Talmage and Wootton, 1937). The thickness and extent of good quality halite is unknown.

The mineral-resource potential for salt in the Estancia, Encino, and Pinos Wells Basins is low to moderate (Figs. 27, 29, 30). The best quality halite is at Salina Lake, where the mineral-resource potential is moderate (Fig. 29). Fair to good quality halite is reported to occur in these basins; however, the thickness and extent of pure halite is unknown. The potential

for development is low because the majority of the halite produced in New Mexico is obtained from refinery wastes of the potash industry (Alto and others, 1965). Some local ranchers mine small quantities of this salt for by their stock animals' use.

Miscellaneous

Several minor and uneconomic occurrences of industrial commodities are found in Torrance County including talc, sulfur, and high-silica quartzites (glass sands). These occurrences are small and they are described only briefly here.

Thin lenses of foliated talc occur within Precambrian greenstones (7N.5E.4.220; Fig. 12; Appendix 1; Edwards, 1978; Woodward and others, 1979). These lenses are about 3 ft (1 m) thick and 820 ft (250 m) long and consist of 92% lepidoblastic talc, 6% hornblende, and 2% opaque minerals. These stratabound deposits are interpreted to have been derived from metamorphism of ultramafic or mafic rocks.

Talc is an important industrial mineral which is used in the manufacture of whiteware, porcelain, tile, and other ceramic materials, as a paint extender, as a lubricant, and in cosmetics. Talc has been mined from the San Andres Mountains in New Mexico; however, production ceased in 1945 when the area became part of the White Sands Military Reservation (Kottlowski, 1965b).

Although talc lenses occur in the Precambrian greenstones in the Manzano Mountains, these deposits are extremely small and they could not be mined economically. Even if larger deposits were discovered at shallow depth, the area is too far from a

commercial market to be considered a viable deposit. These talc deposits, located on the Isleta Indian Reservation, have a very low mineral-resource potential and a very low potential for development.

One occurrence of sulfur has been reported in a gypsum bed in the Yeso Formation southwest of Clines Corners in T.8N., R.11E. (Northrop, 1959, p. 495). Sulfur has not been recovered from gypsum deposits in New Mexico and most of the sulfur deposits in the state are too small to be mined economically (Broderick, 1965).

The mineral-resource potential for sulfur is very low in Torrance County. Sulfur has been reported to occur in only one locality in the Yeso Formation which is not known for economic sulfur deposits.

Locally, the Glorieta Sandstone Member of the San Andres Formation contains up to 97% quartz (Figs. 29-31; Perhac, 1970; Milner, 1978) and could offer a potential source for glass sand and other specialty sands (Bates, 1969). However, these occurrences have not been adequately examined for potential use as glass sand because of limited quantity and long distances to potential manufacturers.

An occurrence of corundum is reported in a Precambrian outlier at Cameleon Hills, southeast Torrance County (Appendix 1, Fig. 20). Blue corundum crystals are found in veinlets within granite. Corundum is used as an abrasive, however recently, corundum has been replaced by silicon carbide and other artificial manufactured products (Bates, 1969). The mineral resource potential of this small occurrence is presumed very low.

DESCRIPTION OF ENERGY RESOURCES AND ENERGY-RESOURCE POTENTIAL

Uranium

Uranium occurs in the stratabound, sedimentary copper deposits in the Scholle district (previously discussed). Uranium concentration rarely exceeds 0.08% U_3O_8 (Tables 8 and 9), although a thin seam reportedly was assayed to contain 13% U_3O_8 (Appendix 1). Uranium concentration is less in the Bursum and Meseta Blanca deposits (Table 8). The mineral-resource potential for uranium as a by-product of copper mining is low to moderate in the Abo Formation in the Scholle district and low in the Bursum Formation and Meseta Blanca Sandstone Member.

Uranium anomalies in the NURE stream-sediment samples are found in the Manzano Mountains (Fig. 8) and could be related to vein-type mineralization in the Precambrian rocks. Although uranium mineralization is not known to occur in the Precambrian rocks in the Manzano Mountains, uranium mineralization is common in Precambrian terranes in New Mexico (McLemore, 1983a). The mineral-resource potential of uranium in Precambrian rocks in the Manzano Mountains is unknown.

Geochemical (Fig. 8) and radiometric (Carson Helicopters, Inc., 1981; Geodata International, Inc., 1979) uranium anomalies occur in the playa deposits in the Estancia Valley. These anomalies are probably representative of evaporation of the playa waters and are not economical.

Anomalous radioactive zones occur along fractures within Paleozoic syenites at Lobo and Pedernal Hills, Torrance County

(Fig. 10; Appendix 1). Uranium analyses range from 0.001 to 0.023% U_3O_8 (Table 15) and radiometric thorium anomalies occur in the vicinity (Carson Helicopters, Inc., 1981). The syenites are brick red and consist of alkali feldspar, quartz, magnetite, sericite, hematite, and amphibole. Purple fluorite is disseminated in the Lobo Hill syenite. The syenites intrude Precambrian metasediments and have been dated at 469 ± 7 m.y. with an initial Sr^{87}/Sr^{86} ratio of 0.723 (Loring and Armstrong, 1980). A thin carbonatite dike, less than 6 inches (15 cm) wide, occurs with the syenite at Lobo Hill (Table 3). Carbonatites are known for economic concentrations of uranium, thorium, niobium, phosphate, rare-earth elements, and copper (Heinrich, 1966); however, additional field reconnaissance is needed to determine the mineral-resource potential in the area.

There are insufficient data available to adequately assess the mineral-resource potential of known uranium and thorium occurrences associated with the carbonatites and syenites at Lobo and Pedernal Hills. Geologic mapping and exploratory drilling are required to determine the uranium and thorium potential in these areas. Uranium is currently being extracted as a byproduct of copper production from only one carbonatite in the world, the Palabora carbonatite in Africa. Furthermore, the declining uranium market and the lack of a thorium market suggest a low potential for development even if economic ore bodies are delineated.

Carbon dioxide (CO_2)

The initial discovery of carbon dioxide (CO_2) was in a water

Table 15 - Chemical analyses of radioactive samples. Analyses by Lynn Brandvold and associates.

	U_3O_8	Th	Fl
1	0.023	0.79	-
2	0.002	300	1.68
3	0.001	-	0.33

1 - Carbonatite, Lobo Hill
2 - Syenite, Lobo Hill
3 - Syenite, Pedernal Hills

well in the Estancia Basin, Torrance County, in about 1925 (Foster, 1980; E. C. Anderson, 1959). By 1934, two carbon dioxide wells were completed in the Estancia Basin (Table 16) and the Witt Ice and Gas Company began production of CO_2 (Harrington, 1935; Talmage and Andreas, 1942). This was the first plant in the United States to produce dry ice by a low-pressure process (Talmage and Andreas, 1942). Initial plant capacity was about 15 tons (14 m) of dry ice per day. In 1936, the plant's capacity was increased to 30 tons (27 metric tons) per day. Initial production of CO_2 from six wells ranged from 140,000 to 860,000 ft^3/day with an average pressure of 415 psi. Total production from the field is unknown. The company ceased production in late 1942 due to water encroachment in the wells, depletion of carbon dioxide reserves, and changing economic conditions (Foster, 1980; Pierce, 1965; Beaumont, 1961). In recent years carbon dioxide has been used primarily for enhanced oil recovery.

Lithology and depth records of the productive intervals are sparce; however, it appears that carbon dioxide was produced from Pennsylvanian limestones and sandstones, probably of the Madera Group and Sandia Formation, and from Precambrian schist and gneiss (Foster, 1980; Foster and Jensen, 1972). Reportedly, the gas was trapped in the small Wilcox and Estancia anticlines, (Roswell Geological Society, 1952). Aerial magnetic data indicate small, dome-shaped features in the vicinity of these anticlines (Fig. 23). Production intervals ranged from 1,200 to 2,000 ft (366 to 610 m; Table 16). Reported gas potentials indicate an average yield of 450 thousand ft^3/day (Foster, 1980;

Table 16 - Wells known to contain carbon dioxide in Torrance County (from Foster, 1980; Foster and Jensen, 1972; Talmage and Andreas, 1942; Anderson and Hinson, 1951; NMBMMR files).

Well	Location	Comp	Potential (Mcfpd)[1]	Pressure (psi)[1]	Production interval (ft)	Total depth (ft)	CO_2%	Other gases	Production Formation	Comments[1]
Estancia Basin										
Estancia 1 Munoz (Strong)	5 T6N R7E	1926	show		528-605	1,346				D&A
Meyers No. 1 Milbourne	12 T6N R7E	1963			<1,844	1,844			Penn.	D&A
Chief No. 1-A Pace	12 T6N R7E	1928	60		1,645-1,760	2,020	99	N-0.97 He-0.03	Penn.	CO_2 produced
Chief No. 1 Pace	12 T6N R7E	1938	1,000		1,591-1,597	2,062	100		Penn.	CO_2 produced
Meyers No. 1 Smith and Pace	12 T6N R7E	1963	50			1,910			Penn.	CO_2 produced
Sinoco No. 1 DeHart	12 T7N R7E	1928	show		214;232	765				D&A
Estancia #2 Gerhart	12 T7N R7E	1935	700		1,265-1,270	1,270			Penn.	CO_2 produced
Sinoco No. 2 DeHart	12 T7N R7E	1931	660	415	1,240-1,251	1,440	99		Penn. limestone	CO_2 produced
Estancia No. 2 DeHart	12 T7N R7E	1934	648	415	1,208-1,215	1,274	99		Penn.	CO_2 produced
Estancia No. 3 DeHart	12 T7N R7E	1936	710		1,204-1,264	1,264			Penn.	CO_2 produced
Estancia No. 4 DeHart	12 T7N R7E	1936	100		<1,236	1,236			Penn.	CO_2 produced
Estancia No. 5 DeHart	12 T7N R7E	1937	250		1,233-1,238	1,258			Penn.	CO_2 produced
Estancia 1 Kellogg	12 T7N R7E	1935	860	405	1,264-1,268	1,268	100		Penn.	CO_2 produced
Estancia 1 Roland SE1/4	12 T7N R7E	1934	show		1,214;1,271	1,359			Penn.	P&A
Estancia #2 Stubbs	12 T7N R7E		show							
Estancia #4 Wilcox Dome	12 T7N R7E		show		>1,050					
Estancia 1 Kutchin	13 T7N R7E	1937	150		<1,428	1,428			Penn.	CO_2 produced
Estancia 1 Crawford NE1/4	32 T7N R7E	1939	show		634	1,355				P&A
Drice 1 Garland NE1/4	32 T7N R7E	1940	show		1,965	2,200			Prec. schist	P&A
Lee 1 Milburn SW1/4	36 T7N R7E	1941	50		1,770-1,813	2,000			Prec. schist	CO_2 produced
Misc.										
Bluehall 1 Kistler	7 T4N R10E	1929	show		<1,780	1,780				
Eidal 1 Mitchell	33 T4N R8E	1947	show			3,592			Penn. Sandia Fm	
48 Pet #1 Greenfield	17 T9N R8E	1936	show		3,460-3,465	2,160				D&A

[1] mcfpd - thousand cubic feet per day
psi - pounds per square inch
P&A - Plugged and abandoned
D&A - Dry and abandoned

Foster and Jensen, 1972). The gas was relatively pure and consisted of greater than 97% CO_2 and 1-2% helium and nitrogen (Harrington, 1935; Anderson and Hinson, 1951). The extent of the reservoir is not known.

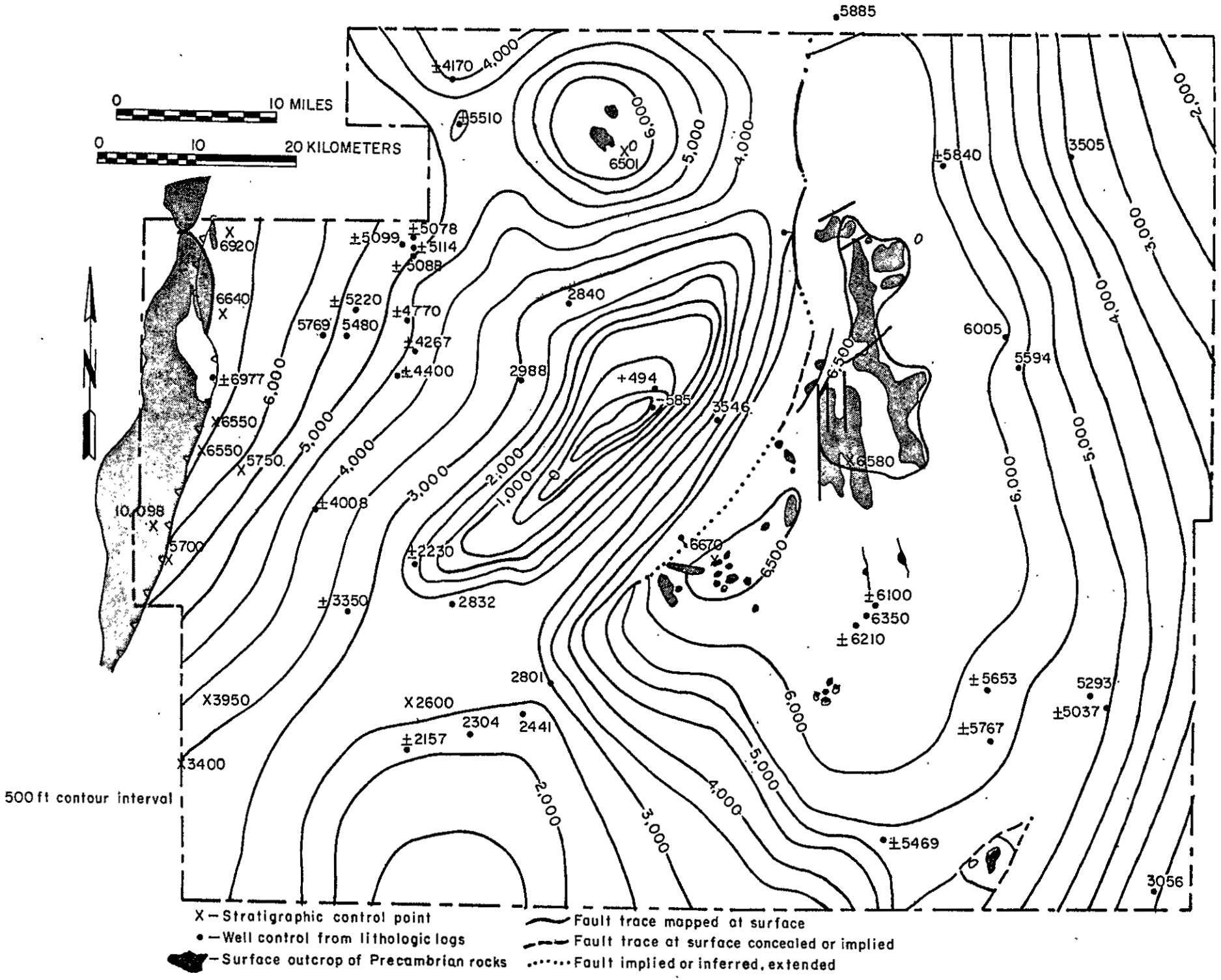
In 1963, shows of carbon dioxide were reported from two wells drilled on the flank of the Estancia anticline. Shows of carbon dioxide also were reported from two wells drilled east of Willard (Table 16). The quality and extent of carbon dioxide in these areas are unknown.

The origin of carbon dioxide accumulations is controversial (E. C. Anderson, 1959; Talmage and Andreas, 1942; Wells and Andreas, 1938) because the gas may be derived from a number of sources including (1) magma, (2) baking of limestones and dolomites, or (3) organic material within Paleozoic sediments. The gas may be derived from a deep-seated magma where the carbon dioxide then migrated along fractures in the Precambrian rocks to Paleozoic reservoirs. Baking of Paleozoic limestones and dolomites as a result of a magma or of high heat flow associated with the Rio Grande rift also may have generated carbon dioxide which migrated into Precambrian and Paleozoic reservoirs. The gas may also be derived from organic material, similar to theories on the origin of petroleum. Carbon dioxide occurs within oil and on top of oil in the Estancia Basin. It is also possible that a combination of these mechanisms generated the carbon dioxide gas and normal structural and stratigraphic traps allowed the gas to accumulate.

The mineral-resource potential for carbon dioxide in the Estancia Basin west of Witt is moderate (Figs. 17-19) and several

promising anticlines or domes have not been tested (Figs. 23, 32). The mineral-resource potential east of Willard and elsewhere within Estancia Basin is low to moderate (Fig. 21). Shows of carbon dioxide were reported from wells in both the northern Estancia Basin and the area east of Willard. Structural traps in the subsurface and thus additional viable exploration targets are suggested by aerial magnetic and Precambrian structure-contour maps (Figs. 23, 32). Modern well-completion methods may eliminate water problems encountered in the past (Foster, 1980). However, the extent of any carbon dioxide reservoirs and the quality of carbon dioxide is unknown. If a suitable carbon dioxide reservoir exists in the Estancia Basin or in the area east of Willard, the potential for development is high. A Shell carbon dioxide pipeline from Colorado lies north of Estancia which makes development of a carbon dioxide field more favorble (Foster, 1980).

Figure 32- Structure-contour map of the Precambrian rocks

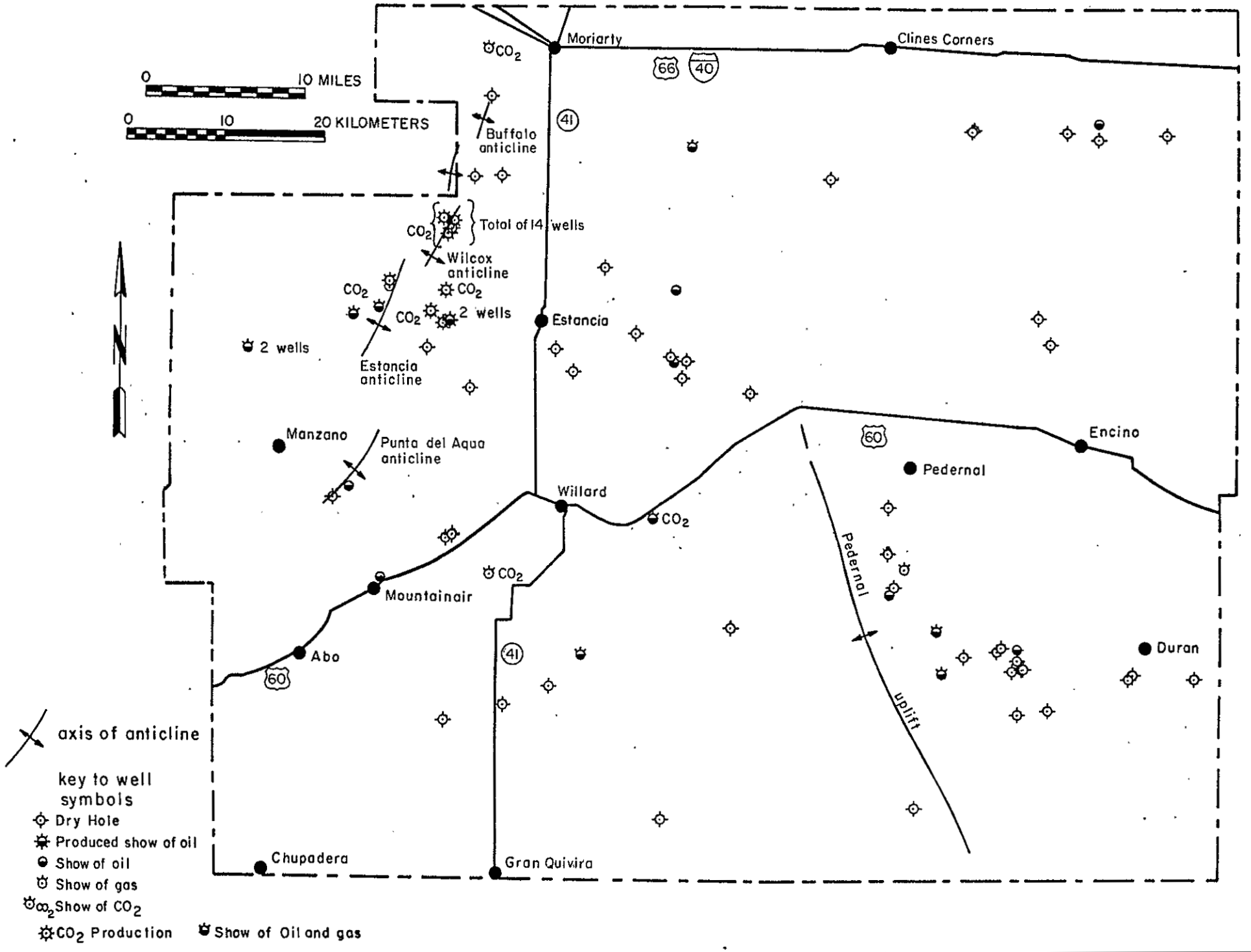


Petroleum (by Virginia McLemore and Robert Colpitts)

Although oil and natural gas have not been produced in Torrance County, petroleum exploration wells have been drilled in the county since the mid-1920's (Fig. 33; Appendix 2). Drilling has been sporadic since 1945 and confined to the vicinity of reported oil shows or promising geologic structures. Numerous shows of oil and natural gas have been reported in rocks ranging in age from Early Pennsylvanian to Permian, but only small quantities of natural carbon dioxide (Fig. 33) have been produced in two small areas in northwestern Torrance County.

Many of the wildcat wells drilled in Torrance County have been drilled on structural highs, but several promising areas have not yet been tested (Figs. 23, 32, 33). Much of the structural relief on top of the Precambrian surface remains speculative. Early structure maps of the Precambrian were published by Andreasen and others (1962), Foster and Stipp (1961), Foster and others (1972), and Cordell (1976). Presently, the only publicly available geophysical studies of Torrance County are aerial magnetic-contour maps (NURE data; Fig. 23; Cordell, 1976; U.S. Geological Survey, 1975a, b, 1976b) and a bouguer gravity map (Cordell and others, 1982; Cordell, 1976). Seismic lines across the Estancia Basin have not been released; however, various sources indicate that the profiles show extreme subsurface structural complexity. To further complicate interpretation of the subsurface structure, much of the surface has yet to be mapped in great detail (Figs. 5, 6). Much of the Estancia Valley is covered by Quaternary lake sediments which conceal structures. Despite these difficulties, a structural-

Figure 33 - Oil and gas tests in Torrance County (see Appendix 2), 1924 - 1981



contour map (Fig. 32) of the Precambrian was compiled from available well data (lithologic logs, geophysical logs, and cuttings; Appendix 2, Table 2-2) and geologic maps of the surface (Figs. 5, 6).

Although carbon dioxide has been produced from Precambrian rocks in northwestern Torrance County, no oil or natural gas shows have been reported from these rocks. Precambrian rocks rarely contain oil or gas and it is unlikely that these units are oil or gas reservoirs.

Scattered tests throughout the county contain shows of oil and natural gas from Pennsylvanian rocks (Figs. 11-16; Appendix 2). Samples of Pennsylvanian black shale were distilled and found to yield oil (Winchester, 1933; Bates, 1942), but sandstones are the dominant reservoir for oil and gas. However, in the Estancia Basin, petroleum shows also occur in sandy limestones. Lithologies of Pennsylvanian rocks cannot be distinctly interpreted from geophysical logs and lithologic logs are not available. Therefore, it is difficult to determine which units are most likely to contain source rocks or reservoirs.

Although no shows of oil or gas have been encountered in the Bursum or San Andres Formations, a number of shows have been reported in the Abo and Yeso Formations (Appendix 2). Most of these reported shows occur on the flanks of the Pedernal uplift (Fig. 33) where arkosic sandstones in the Abo and Yeso Formations tend to be thicker and more continuous than in western Torrance County. Additional shows of oil occur in Abo sandstones on Chupadera Mesa in southwest Torrance County. Most of the oil and gas shows reported from the Yeso Formation occur in thin,

discontinuous petroliferous limestones in the lower part of the Yeso Formation (Bates and others, 1947).

Recent discoveries of dry gas in the Abo Formation in north-central Chaves County make the Abo Formation an attractive target. The Federal Energy Regulatory Commission has designated the Abo Formation in Chaves County a "tight" gas sand which qualifies the unit for higher gas prices. Gas-bearing, low permeable sandstones occur in the upper two thirds of the formation (Broadhead, 1982, 1983). Gas accumulations are controlled stratigraphically (Broadhead, 1982). Average Abo gas wells in Chaves County have initial production tests of over 1,000 MCFPD (thousand cubic feet per day, calculated absolute openflow) after acidization and artificial fracturing of the reservoir rock.

The Abo Formation in Torrance County is similar to Abo rocks in Chaves County and gas shows have been encountered in Abo sandstones throughout Torrance County. Gas shows near the southeastern part of the Pedernal uplift suggest local entrapment. The main difference between the two areas is the lack of abundant source rocks in Torrance County and the separation of the Estancia Basin from the petroleum-producing Permian Basin by the Pedernal uplift.

Although there are no oil or gas shows in the San Andres Formation in Torrance County, this unit is productive in southeastern New Mexico. However, the San Andres Formation in Torrance County is thinner and consists of more anhydrite than in the Permian Basin. Furthermore, the unit occurs at or in the

shallow subsurface throughout much of Torrance County (Figs. 26-31), so that any petroleum once present in the San Andres may have leaked out. Therefore, it is unlikely that oil or gas occurs in commercial quantities in the San Andres Formation.

Several potential structural traps exist in Torrance County (Fig. 32). Two wells have been drilled on the Punta del Agua anticline and oil shows were reported from one of these wells (Appendix 2). Two wells were drilled near the Buffalo anticline (Figs. 32, 33) and a carbon dioxide show was reported from one of them. The Estancia Basin is a structural basin and consists of about 2,300 ft (701 m) of Paleozoic sediments (Rocky Mountain Association of Geologists and others, 1951). Very little is known about the structures in east-central Estancia Basin near the Pedernal uplift. Geophysical and well data (Figs. 23, 32) suggest that this area may be intensely faulted. The major structural feature in central Torrance County is the Pedernal uplift; shows of oil and gas were reported from wells drilled on the southeast flank (Fig. 32).

Recent success in finding petroleum in the overthrust belt of the western United States has led at least two petroleum companies to examine Torrance County in view of an overthrust model. Precambrian rocks are exposed in several localities in central Torrance County (Fig. 20; Kelley, 1972) and it is possible that these Precambrian rocks could have been overthrusted onto younger Paleozoic sedimentary rocks. If Paleozoic sediments occur beneath the Precambrian units they could have petroleum potential. A possible thrust fault has been mapped northeast of Moriarity in the Estancia Valley in Santa Fe

County (Read and others, 1944). There are many problems with this theory because available data are insufficient to refute or support an overthrust model in this area. Detailed surface mapping and good seismic profiles are needed to test their hypothesis. If overthrusting does exist in central Torrance County, a re-evaluation of the petroleum potential in this area would be necessary.

The mineral-resource potential for oil and natural gas in the Abo Formation and Pennsylvanian rocks is low to moderate near favorable anticlines or domes in western Estancia Basin (Buffalo and Punta del Agua anticlines). The petroleum potential in Permian and Pennsylvanian rocks in the northern Chupadera Mesa in southwestern Torrance County is moderate due to favorable structural traps (Foster and Grant, 1974). The mineral-resource potential in the Abo Formation and Pennsylvanian rocks in central Estancia Basin is low to moderate where petroleum may be trapped by faults (Foster and Grant, 1974). The mineral-resource potential for natural gas in Abo "tight" sandstones in the southern Pedernal uplift is low. Elsewhere along the Pedernal uplift the petroleum potential is very low because of a thin sedimentary section (Figs. 24, 32; Foster and Grant, 1974). The petroleum potential in eastern Torrance County is low because the section becomes thicker. Mineral-resource potential might increase further east toward the producing field in Chaves County. The mineral-resource potential for oil and natural gas in the Precambrian rocks and the Bursum and San Andres Formations is very low. It is low in the Yeso Formation in the vicinity of

favorable structural features, but very low elsewhere. In the vicinity of the Pedernal uplift, where no wells have been drilled, the mineral-resource potential for petroleum is unknown, but probably low because of the thin sedimentary section present over the uplift.

Coal

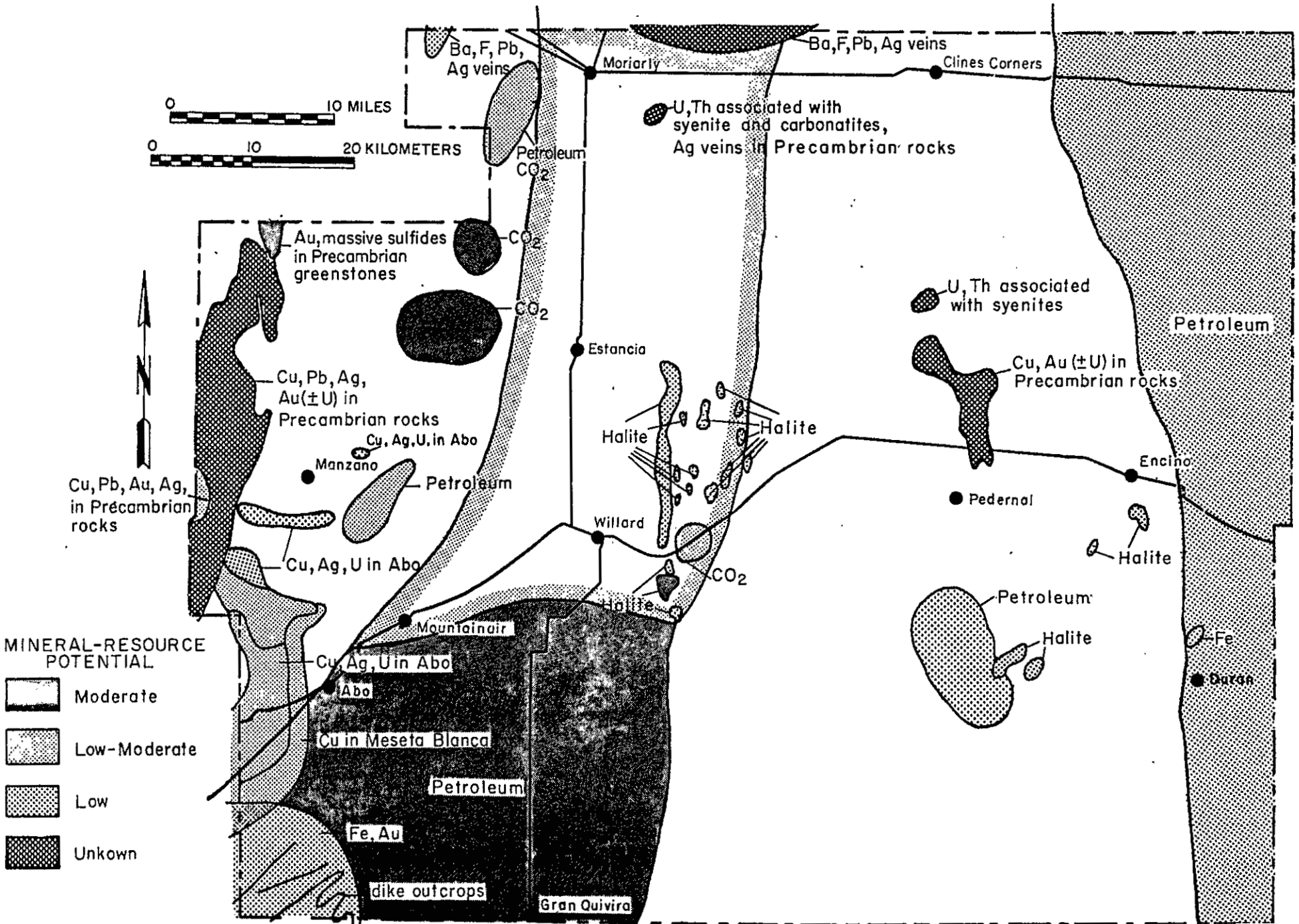
Most of the economic coals in New Mexico are Cretaceous age. There are no Cretaceous-age rocks present in Torrance County because of nondeposition or erosion. No other coal-bearing units are found in Torrance County, although carbonaceous black shales occur in the Madera Group. Therefore, the mineral-resource potential for coal is very low.

As is true with all preliminary investigations, additional studies are necessary to assess adequately the mineral-resource potential in Torrance County and these assessments must be re-evaluated as economic conditions and geologic interpretations change (Brobot and Goudarzi, 1984). The mineral-resource potentials for various commodities in Torrance County are summarized in Table 17 and Figure 34. The greatest mineral-resource potentials in Torrance County are for sand, gravel, limestone, dolomite, clay, and dimension stone (Figs. 26-31), but the potential for development of these resources depends on highway construction and development and subdivision development. Areas in Torrance County exhibit a moderate mineral-resource potential for high-calcium limestones and for adobe, halite, carbon dioxide, and petroleum (Table 17; Figs. 26-31, 34). The mineral-resource potential for gold and silver in Precambrian greenstones in the Manzano Mountains is also moderate. The mineral-resource potential for coal, talc, sulfur, and Precambrian, stratabound iron ore is very low in Torrance County. Geologic evidence and comparisons with analogy to existing mineralized geologic environments suggest several areas may have potential for base metals, precious metals, and uranium deposits (Figs. 17-22, 34); however, insufficient information exists to assess adequately some of these areas. Therefore, the mineral-resource potentials of these deposits are classified as unknown until additional information becomes available.

Table 17 - Summary of mineral-resource potential in Torrance County. See Figure 22.

Commodity/Type of deposit	Formation	Geographic location	Mineral-resource potential (occurrence)
METALLIC			
Stratabound copper deposits ± Ag, Au, U, Pb, Zn, V, Mo	Abo Formation	Scholle district Northern Manzano Mountains	low to moderate low to moderate
	Bursum Formation	Scholle district	low
	Meseta Blanca Sandstone Member (Yeso Formation)	Chupadera Mesa and Scholle area	low to moderate
Iron-replacement deposits ± Au	Yeso Formation adjacent to dikes and sills	Chupadera Mesa	low
	Yeso Formation	Duran	low
Uranium and thorium veins	Paleozoic syenites and carbonatites	Lobo Hill and Pedernal Hills	unknown
Silver veins	Precambrian rocks	Lobo Hill	unknown
Gold and silver (± Cu)	Precambrian greenstone terranes	Manzano Mountains Pedernal Hills	moderate unknown
Volcanogenic massive sulfides	Precambrian greenstone terranes	Manzano Mountains, Pedernal Hills	unknown
Precambrian stratabound iron-ore	Precambrian quartzites, schists	Manzano Mountains, Pedernal Hills	very low
Copper (structure-controlled) ± Au	Pedernal granite (Precambrian)	Pedernal Hills	unknown
Copper-lead (structure-controlled) ± Au, Ag	Precambrian metasediments and metavolcanics	Manzano Mountains	low to moderate
NONMETALLIC			
Barite, fluorite veins ± Lead, silver (structure-controlled)	Madera Group Yeso Formation	Edgewood North-central Torrance County (near Moriarty)	low unknown
Aggregate materials Limestone and dolomite	San Andres, Bursum Formations, Madera Group	Western Torrance County	high to moderate
	Yeso Formation	Eastern Torrance County	low to moderate
Sand	Quaternary units	All of Torrance County	high
Gravel	alluvial fans, pediment deposits, bench deposits, caliche	Adjacent to Manzano Mountains, Estancia Valley, eastern Torrance County	high
Dimension stone	Precambrian quartzite	Manzano Mountains	moderate to high
		Lobo Hill and Pedernal Hills	moderate
	Madera and San Adres limestones	Western Torrance County	high
	Ogallala or Quaternary caliche deposits	Eastern Torrance County	low
High Ca limestones	Madera Group	Manzano Mountains	moderate
Gypsum	Yeso Formation	All of Torrance County	low to moderate
	Quaternary dune fields	Estancia Valley, Pinos Wells, Encino	low to moderate
Adobe	Quaternary deposits	Near Mountainair	moderate
Salt (halite)	Quaternary playa deposits	Estancia Valley, Pinos Wells, Encino	low
		Salina Lake	moderate
Miscellaneous Talc	Precambrian greenstones	Manzano Mountains	very low
Sulfur	Yeso Formation	Clines Corners	very low
High-silica sand	Glorieta Sandstone member	Eastern Torrance County	unknown
clay	Madera Group	Western Torrance County	moderate to high
CO_2	Precambrian, Pennsylvanian units	Estancia Valley - Wilcox and Estancia anticlines	moderate
		East of Willard	low to moderate
Petroleum	Abo Formation and Pennsylvanian units	Estancia Basin - Punta del Agua and and Buffalo anticlines	low to moderate
		Central Estancia Basin Chupadera Mesa Eastern Torrance County	low to moderate moderate low
	Precambrian, Bursum, and San Andres Formations	Torrance County	very low

Figure 34 — Mineral-resource potential in Torrance County excluding aggregate, dimension stone, limestone, and gypsum resources (see Table 17).



(1) Detailed geologic mapping and geochemical studies in Precambrian greenstone terranes in the Manzano Mountains and Pedernal Hills and in Precambrian granites in the Pedernal Hills are needed to determine the mineral-resource potential for base and precious metals and uranium in the Pedernal Hills.

(2) Additional geologic mapping and geochemical studies are required at Lobo Hill to determine the potential for (a) base and precious metals in greenstones and other Precambrian rocks and (b) uranium, thorium, and other commodities associated with alkalic rocks and carbonatites.

(3) The Meseta Blanca Sandstone Member should be examined along the outcrop and in the subsurface to determine the potential for stratabound copper deposits.

(4) North-central Torrance and southern Santa Fe Counties should be mapped and sampled to determine the potential for additional barite, fluorite, lead, and silver veins.

(5) Detailed mapping and sampling of the Chupadera iron ore deposits is needed if a strong demand for local sources of iron ore develops.

(6) Isopach facies and structure-contour maps of several formations in the Estancia Basin and eastern Torrance County should be completed in order to delineate favorable areas for oil, gas, and carbon dioxide accumulations.

(7) Additional surface mapping of the structural geology in Torrance County is needed in order to delineate possible

structural traps in central Torrance County for oil, gas, and carbon dioxide.

(8) Chemical sampling of Pennsylvanian and Permian limestones and Tertiary and Quaternary caliche is needed to determine the potential for high-calcium limestones.

(9) Aggregate resources should be mapped and sampled in greater detail prior to extraction of such materials. In eastern Torrance County, extreme caution must be taken when Yeso sediments are used because these units are poor in quality due to high amounts of gypsum, although small local units may be adequate.

(10) Chemical sampling of the Glorieta Sandstone Member is required to determine the potential for high-silica sand resources.

(11) Any areas with active claims should be field checked (Fig. 7).

(12) Drilling is required in areas where the Precambrian rocks are near the surface (Fig. 24) or at depths of about 500 ft (152 m) to evaluate them for base and precious metals deposits.

(13) Examination of other favorable areas for metal deposits delineated by the HSSR data is required. In particular Areas C, I, and L in Figure 8 should be examined.

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APPENDIX 1

MINERAL AND OTHER COMMODITY OCCURRENCES, DEPOSITS, AND MINES IN TORRANCE COUNTY

Introduction

The following compilation of mineral and other commodity occurrences (excluding oil, gas, and CO_2 tests) is the most comprehensive tabulation of mineral occurrences in Torrance County. It is probable that additional occurrences will be discovered in the future. For the purposes of this report, any locality where mineralization or materials prospects are found is considered an occurrence, including sand and gravel (materials) pits.

Each description is a brief account of the location, commodities present, production, and geology of the occurrence that was compiled from the literature, unpublished sources, and field reconnaissance. Each occurrence is listed alphabetically and numbered according to its location. A complete index by commodity quadrangle is included. Each occurrence is plotted in Figures 10-16. The metal and nonmetal occurrences are arranged alphabetically and the material pits are arranged by township and range.

Explanation of descriptions

The descriptions of mineral occurrences in this section are brief summaries of published and unpublished information. However, not all of the available information could be included; information for some occurrences is considered confidential by a

company or the information is very extensive. Very little information could be obtained for some occurrences. Each description consists of 12 entries or less (depending on available information), and the entries are listed by number as described below.

1: Occurrence number refers to the location or approximate location of each mineral occurrence, prospect, deposit, or mine. The numbering system used is based upon the township, range, and section land-grid system (Fig. 3) and is used by the New Mexico State Engineer for numbering water wells and springs. By this system, each occurrence has a unique location number consisting of four parts separated by periods (e.g., 3N.5E.15.441). The first part refers to the township, the second part to the range, and the third part to the section. The fourth part places the occurrence within the nearest quarter-quarter-quarter section block as indicated in Figure 3. An occurrence designated 3N.5E.15.441 is located in the NW 1/4 SE 1/4 SE 1/4 of section 15, T. 3 N., R. 5 E. Some occurrences are located only to the nearest section, quarter-section, or quarter-quarter section because the occurrence can not be located more accurately or the occurrence extends over the entire given area. In unsurveyed areas the locations are approximated by projecting section lines.

2: Name of the occurrence, prospect, deposit, or mine as found in the literature. Aliases are given in parentheses.

3: Location of the occurrence by the section, township, and range and by latitude and longitude.

4: Names of the 7 1/2-minute or 15-minute topographic quadrangle

maps; the 30-minute by 60-minute topographical quadrangle map is in parentheses.

5: Mining district or geographical area.

6: Commodities present at the locality.

7: Brief description of the extent of development or prospecting.

8: Production statistics for various commodities.

9: The formation name and geologic age of the host rock.

10: Brief description of the geology, host rock, and character of the deposit; including chemical analyses and other pertinent information.

11: Comments or additional information.

12: References or sources of information are listed in an abbreviated form. Published reports are listed with last name of author(s) and year of publication in parentheses; the complete citation may be found in the reference section. Unpublished sources are abbreviated as follows: FN (field notes); NMBMMR files (New Mexico Bureau of Mines and Mineral Resources unpublished files); USAEC files (U.S. Atomic Energy Commission files); PRR (Preliminary Reconnaissance Reports of the Atomic Energy Commission); USBM files (U.S. Bureau of Mines files); CRIB (Computerized Resource Information Bank, U.S. Geological Survey); MILS (Mineral Industry Location Survey, U.S. Bureau of Mines); NMSHD (New Mexico State Highway Department, 1975); PC (personal communication); and WC (written communication). Copies of most of these reports are available for inspection at the New Mexico Bureau of Mines and Mineral Resources.

Commodity index (excluding materials pits)

Copper, uranium, and vanadium

Abo mine	2N.5E.3.414
Abo mining claims	3N.5E.23.111
Copper Girl 1-6	4N.5E.28.110
Gabaldon mine	2N.5E.13.343
McCandless	5N.5E.34
Old Abo claims	3N.5E.27.200
Pioneer mine	3N.5E.15.441
Rattlesnake 1-4	3N.5E.15.233
Scholle-1	3N.5E.10.300
Scholle	2N.5E.10
Thelma	3N.5E.15.423
Thomas and Melbourn	4N.5E.15
Unknown	3N.5E.10.314
Unknown	3N.5E.11.440
Unknown	3N.5E.14.340

Gold and silver

Abo mine	2N.5E.3.414
Gabaldon mine	2N.5E.13.343
Thomas and Melbourn	4N.5E.15

Uranium and vanadium (see copper)

*Consolidated Gas and Mining	7N.12E.28,29
Unknown	9N.9E.26.333
*Unknown	9N.9E.27.444
*Unknown	9N.9E.27.443

* includes thorium

Iron ore

Adams Iron pit	1N.5E.13
*Chupadera	1N.6E.29.333
*Garner	3N.15E.17
*Geoslim pit	1N.6E.31.222
Iron King mine	1N.5E.13

* trace gold

Barite, fluorite, and lead

Shockley	9N.7E.5.100
Tina	9N.7E.5.300
Vincent Moore	9N.7E.6

1: 2N.5E.3.414
2: Abo mine (Prospect #17, Uranium prospect, Abel, Scholle, Tom Arnett prospect)
3: SE1/4 3 T2N R5S 34°25'20"N 106°24'30"W
4: Scholle 7-1/2 (Socorro) Elevation 5,910 ft
5: Scholle district-Manzano Mountains
6: Cu, Ag, Au, U, V
7: 2 shafts (one 75-ft deep), dumps, open pit, 40 ft decline
9: Permian Abo Formation
10: radioactive minerals associated with copper minerals and organic debris in red and gray (bleached) sandstone, secondary uranium minerals reported, 0.014-0.107% U_3O_8 (Gibson, 1952)
12: FN 7/2/80; Pierson and others (1982, #59); Myers (1977); U.S. Atomic Energy Commission (1970, p. 219); Hilpert (1969); Phillips (1960); Collins and Nye (1957); Soulé (1956); Hilpert and Corey (1955, #84, 86); Gibson (1952, #2); Gott and Erickson (1951); Lindgren and others (1910); PRR D-245 (1951); RG-1-51 (1951); USAEC files (1953); MILS (1981)

1: 3N.5E.23.111
2: Abo mining claims (Sandstone copper)
3: NE1/4 22, NW1/4 23 T3N R5E 34°28'30"N 106°24'00"W
4: Scholle 7-1/2 (Socorro) Elevation 6,240 ft
5: Scholle district-Manzano Mountains
6: Cu, U, V
7: 40 ft adit, open cut, dumps
8: radium ore shipped in 1916 (USBM), copper production
9: Permian Abo Formation
10: radioactive minerals associated with copper oxides and organic debris in red and bleached gray limy conglomerates, 0.001%, 0.002% U_3O_8, 6.36%, 11.11% Cu (NMBMMR chem lab, 11/30/81, #1527, 1528), 2 in seam of 13% U_3O_8 reported
12: FN 6/24/81; Pierson and others (1982, #60, 62); Myers (1977); U.S. Atomic Energy Commission (1970, p. 215); Hilpert (1969); Hilpert and Corey (1955, #84); Lindgren and others (1910); PRR DEB-RRA-569 (1955); DEB-RRA-1401 (1954), supplement; NMBMMR files (1954); USBM files (1949); MILS (1981)

1: 1N.5E.13
2: Adams iron pit
3: 13 T1N R5E 34o18'36"N 106o22'21"W
4: Chupadera 7-1/2 (Socorro)
5: Chupadera
6: Fe
12: MILS (1981)

1: 6N.12E.17.200
2: Berry mine
3: N1/2 17 T6N R12E
4: Pedernal 7-1/2, Pedernal Mountain 7-1/2 (Vaughn)
5: Pedernal Hills area
6: Cu, Au
7: incline
8: no production
9: Precambrian pedernal pluton
10: copper along fault zone in granite, chalcocite and copper oxides with associated gold reported
12: Jeremy Setter (WC, 11/83)

1: 1N.6E.29.333
2: Chupadera (Blackington-Harris, Lilt Iron Lodes, Fite)
3: 29 T1N R6E 34°16'53"N 106°20'15"W
4: Chupadera 7-1/2 (Socorro)
5: Chupadera
6: Fe, Au
9: Permian Yeso Formation intruded by Tertiary diorite dikes
10: iron bodies occur as irregular, short and thick bodies replacing limestones, 39.6% Fe, 0.02 oz/ton Au, no Ag (NMBMMR chem lab, 9/14/83)
12: FN 8/11/83; Kelley (1949); Harrer and Kelly (1963); MILS (1981)

1: 7N.12E.28,29
2: Consolidated Gas and Mining
3: 28, 29 T7N R12E
4: Pedernal Mountain 7-1/2 (Vaughn)
5: Pedernal Hills
6: U, Th
7: 10 pits
9: Late Paleozoic syenite dike in Precambrian schists
10: radioactive zone along dike contact
12: FN 9/21/83; U.S. Atomic Energy Commission (1970, p. 217)

1: 4N.5E.28.110
2: Copper Girl 1-6
3: NW1/4 28 T4N R5E 34°32'35"N 106°25'55"W
4: Torreon 15' (Belen) Elevation 6,820 ft
5: Scholle district-Manzano Mountains
6: Cu, U, V
7: 2 open cuts (decline-adit), decline adit, 30 to 50 ft deep
9: Permian Abo Formation
10: radioactive minerals associated with copper oxides in fractured red and bleached bluff conglomerate and arkose, 1-2 ft thick uraninite with chalcocite reported, 0.005% U_3O_8, 0.83% Cu (NMBMMR chem lab, 11/30/82, #1526)
12: FN 6/17/81; Krason and others (1982); Pierson and others (1982, #65); O. J. Anderson (1980); LaPoint (1979); Myers and McKay (1974); U.S. Atomic Energy Commission (1970, p. 218); Phillips (1960); Collins and Nye (1957); Lovering (1956); USAEC files (1955)

1: 2N.5E.13
2: Gabaldon mine
3: 13 T2N R5E 34°23'27"N 106°22'34"W
4: Scholle 7-1/2 (Socorro)
5: Scholle district-Manzano Mountains
6: Cu, Ag, Au, U
7: Large open pit, 20 ft adit
8: production unknown
9: Permian Yeso Formation - Meseta Blanca Sandstone Member
10: copper mineralization in coarse-grained, white to gray quartz sandstone (possible beach sandstone)
12: FN 1/30/84; MILS (1981)

1: 3N.15E.17.421
2: Garner (Duran)
3: 17 T3N R15E 34°29'10"N 105°23'15"W
4: Duran 7-1/2 (Corona)
5: Duran area
6: Fe
7: 40 ft shaft, shallow pits
8: no production known
9: Permian Yeso Formation
10: limonite in reddish sandstone; sample 33.8% Fe (Harrer and Kelly, 1963); trace Au, no Ag (NMBMMR chem lab, 10/22/83)
12: FN 9/25/83; Harrer and Kelly (1963); Kelley (1949); Sheridan (1947); MILS (1981)

1: 1N.6E.31.222
2: Geoslim pit
3: 31 T1N R6E 34°16'30"N 106°20'42"W
4: Chupadera 7-1/2 (Socorro)
5: Chupadera area
6: Fe
10: 47% Fe, 0.02 oz/ton Au, no Ag (NMBMMR chem lab, 9/14/83)
12: FN 8/11/83; MILS (1981)

1: 1N.5E.13
2: Iron King mine
3: 13 T1N R5E 34°18'30"N 106°22'30"W
4: Chupadera 7-1/2 (Socorro)
5: Chupadera area
6: Fe
12: MILS (1981)

1: 5N.5E.34
2: McCandless prospect
3: 34 T5N R5E
4: Torreon 15' (Belen)
5: Manzano Mountains
6: Cu, U
7: no workings found, 3'x 4'x 3' pit reported
9: Permian Abo Formation
10: malachite, azurite in sandstone
11: could not find on 7/2/80
12: U.S. Atomic Energy Commission (1970, p. 214)

1: 3N.7E.5,6
2: Mountainair adobe operation
3: 5, 6 T3N R7E
4: Mountainair 15' (Belen)
5: in Mountainair
6: adobe (traditional)
7: pits
8: 5,000 bricks per year in 1980
9: Quaternary valley alluvium
12: E. W. Smith (1982a, b)

1: 3N.5E.27.200
2: Old Abo claims (Abo claims)
3: NE1/4 27 T3N R5E 34°27'30"N
4: Scholle 7-1/2 (Socorro) Elevation 6,180 ft
5: Scholle district-Manzano Mountains
6: Cu, U, V
7: several shallow prospect pits
9: Permian Abo Formation
10: Sandstone-tabular, ore may occur at depth
12: FN 6/24/81; Myers (1977); U.S. Atomic Energy Commission (1970, p. 195); Collins and Nye (1957); MILS

1: 3N.5E.15.441
2: Pioneer mine (Hannie, Pioneer copper mine, Unknown, Cole mine)
3: SE1/4 15 T3N R5E 34°29'10"N 106°24'00"W
4: Scholle 7-1/2 (Socorro) Elevation 6,200 ft
5: Scholle district-Manzano Mountains
6: Cu, U, V
7: 20 ft adit, pits
9: Permian Abo Formation
10: uranium minerals associated with copper minerals and organic debris in bleached sandstones and conglomerates, carnotite or tyuyamunite reported, 0.002% U_3O_8, 4.18% Cu (NMBMMR chem lab, 11/30/81, #1525)
12: FN 6/24/81; Krason and others (1982); Pierson and others (1982, #63); LaPoint (1979); Myers (1977); Collins and Nye (1957); PRR DEB-RRA-569 (1953); MILS (1981)

1: 3N.5E.15.233
2: Rattlesnake #1-4
3: SW1/4 NE1/4 15 T3N R5E 34°29'10"N 106°24'30"W
4: Scholle 7-1/2 (Socorro) Elevation 6,090 ft
5: Scholle district-Manzano Mountains
6: Cu, U, V
7: pit, trench, dumps
9: Permian Abo Formation
10: radioactive minerals associated with copper oxides in arkosic conglomerate (bleached); yellow-green uranium mineral reported
12: FN 6/24/81; Pierson and others (1982, #63); Myers (1977); Hilpert (1969); Hilpert and Corey (1955, #84); PRR DEB-RRA-1180 (1954); MILS (1981)

1: 3N.5E.10.300
2: Scholle-1 (Laurita)
3: SW1/4 10 T3N R5E 34°30'00"N 106°24'55"W
4: Scholle 7-1/2 (Socorro) Elevation 5,900 ft
5: Scholle district-Manzano Mountains
6: Cu, U, V
7: pits, adits, tunnels (one reported to be 70 ft long)
9: Permian Abo Formation
10: radioactive minerals associated with copper oxides and organic debris in bleached red-bed sandstones
11: north of claim post-SW corner Laurita
12: FN 7/2/80, 6/26/81; Krason and others (1982); Pierson and others (1982, #56); LaPoint (1979); Myers (1977); Phillips (1960); Soulé (1956); Lovering (1956); Gibson (1952, p. 28, #6); PRR RG-6-51

1: 2N.5E.10
2: Scholle
3: 10 T2N R5E 34°24'30"N 106°24'30"W
4: Scholle 7-1/2 (Socorro) Elevation 5,900 ft
5: Scholle District-Manzano Mountains
6: U, Cu
9: Permian Abo Formation (red beds)
10: 0.008% in sandstone
12: Pierson and others (1982, #56)

1: 9N.7E.5.100
2: Shockley (Blanco, Vincent Moore)
3: NW1/4 5 T9N R7E 35°2'12"N 106°13'13"W
4: Edgewood 7-1/2 (Albuquerque)
5: Edgewood area
6: barite, fluorite, Pb, Ag
7: pits, trenches, 25 ft shaft, 10 ft drift
8: 50 tons of barite ore amounting to $250 in 1956 (New Mexico State Inspector of Mines, 1956)
9: Pennsylvanian Madera Limestone
10: vein trending N30°W, traceable for 1,500 ft, 4 ft wide maximum
12: Williams and others (1964); New Mexico State Inspector of Mines (1956); Dianna Normand (WC, 1982); MILS (1981)

1: 3N.5E.15.423
2: Thelma (Miners Dream, McTerry, Thelma-Ann, Abo)
3: SE1/4 15, NE1/2 22 T3N R5E 34°29'00"N 106°24'10"W
4: Scholle 7-1/2 (Socorro) Elevation 6,400 ft
5: Scholle district-Manzano Mountains
6: Cu, U, V
7: 30 ft adit
9: Permian Abo Formation
10: radioactive minerals associated with copper oxides in red and bleached gray arkose
11: north of claim post SW corner Thelma
12: FN 6/24/81; Pierson and others (1982, #60-61); Myers (1977); PRR DEB-RRA-569 (1953)

1: 4N.5E.15
2: Thomas and Melbourn
3: 15 T4N R5E 34°34'20"N 106°24'30"W
4: Torreon 15' (Belen)
5: Scholle district-Manzano Mountains
6: U, Cu, Ag
7: no workings found
9: Permian Abo Formation
10: one sample 2.15% U in sandstone
11: could not be located on 6/17/81
12: FN 6/17/81; Pierson and others (1982, #66)

1: 9N.7E.5.300
2: Tina
3: SW1/4 5 T9N R7E 35°01'44"N 106°13'12"W
4: Edgewood 7-1/2 (Albuquerque)
5: Edgewood area
6: barite, fluorite, Pb
7: 22 ft shaft, 10 ft drift, 30x8x20 ft cut
9: Pennsylvanian Madera Limestone
10: 2-ft wide vein trending N75°W, 49.2% $BaSO_4$, 20.7% CaF_2 (Williams, 1966)
12: T. J. Smith (1982); McAnulty (1978); Williams (1966); Williams and others (1964); Dianna Normand (WC, 1982); MILS (1981)

1: 1N.14E.19.134
2: Unknown
3: NW1/4 19 T1N R14E
4: Corona North 7-1/2 (Corona)
5: Camaleon Hills area
6: corundum
7: pit
8: no production
9: Precambrian granite
10: blue corundum veinlets in granite
12: David Menzie, PC, 4/84

1: 3N.5E.10.314
2: Unknown
3: SW1/4 10 T3N R5E 34°20'00"N 106°24'55"W
4: Scholle 7-1/2 (Socorro)
5: Scholle district-Manzano Mountains
6: Cu, U, V
9: Permian Abo Formation
10: Sandstone-tabular
12: FN 7/2/80, 6/26/81; Myers (1977); Phillips (1960); Soulé (1956); MILS (1981)

1: 3N.5E.11.440
2: Unknown
3: SE1/4 SE1/4 11 T3N R5E 34°29'38"N 106°23'44"W
4: Scholle 7-1/2 (Socorro)
5: Scholle district
6: Cu, U, V
9: Permian Abo Formation
10: Sandstone
12: MILS (1981)

1: 3N.5E.14.340
2: Unknown
3: SE1/4 SW1/4 14 T3N R5E 34°28'44"N 106°23'21"W
4: Scholle 7-1/2 (Socorro)
5: Scholle district
6: Cu, U, V
9: Permian Abo Formation
12: MILS (1981)

1: 4N.5E.20,29
2: Unknown
3: 20, 29 T4N R5E
4: Torreon 15' (Belen)
5: Scholle district
6: Cu, U
7: pits
9: Permian Bursum Formation
12: Krason and others (1982); LaPoint (1979)

1: 4N.5E.21
2: Unknown
3: 21 T4N R5E
4: Torreon 15' (Belen)
5: Scholle district
6: Cu, U
7: pits
9: Permian Abo Formation
12: Kranson and others (1982); LaPoint (1979)

1: 7N.5E.2.341
2: Unknown
3: SW1/4 2 T7N R5E
4: Bosque Peak 7-1/2 (Belen) Elevation 6,840 ft
5: Manzano Mountains
6: Au, Ag, Cu
7: no workings--outcrop
8: no production
9: Precambrian greenstone
10: mineralized greenstone sample assayed at 540 ppm Cu, 0.035 oz/ton Ag, and 0.001 oz/ton Au
12: Edwards (1978)

1: 7N.5E.4.220
2: Unknown
3: NE1/4 4 T7N R5E
4: Bosque Peak 7-1/2 (Belen)
5: Manzano Mountains
6: talc
7: pits(?)
8: no production
9: Precambrian greenstone
10: 3 ft thick lenses of talc, 92% talc, 6% hornblende, 2% opaques
12: Woodward and others (1979); Edwards (1978)

1: 8N.11E
2: Unknown
3: T8N R11E
4: Lobo Hill 15' (Vaughn)
5: Pedernal Hills
6: S
7: no development
8: no production
9: Permian Yeso Formation
10: occurrence of sulfur in Yeso gypsum
12: Northrop (1959)

1: 9N.9E.26.333
2: Unknown
3: SW1/4 SW1/4 26 T9N R9E 34o58'12"N 105o57'40"W
4: Lobo Hill 15' (Vaughn)
5: Pedernal Hills
6: Au, Ag
7: prospect pit
8: no production
9: Precambrian schists
10: no uranium found; trace Au, 0.06 oz/ton Ag (NMBMMR chem lab, 2/84)
12: FN 9/20/83; MILS (1981)

1: 9N.9E.27.444
2: Unknown
3: SE1/4 27 T9N R9E 34o58'8"N 105o57'58"W
4: Lobo Hill 15' (Vaughn)
5: Pedernal Hills
6: U, Th
7: prospect pit
8: no production
9: Paleozoic(?) syenite intruding Precambrian schists
12: FN 9/20/83; MILS (1981)

1: 9N.9E.27.443
2: Unknown
3: SE1/4 SE1/4 27 T9N R9E 34°58'12"N 105°57'46"W
4: Lobo Hill 15' (Vaughn)
5: Pedernal Hills
6: U, Th
7: prospect pit
8: no production
9: Paleozoic(?) syenite intruding Precambrian schists
10: radioactive carbonatite cutting syenite
12: FN 9/20/83; MILS (1981)

1: 9N.7E.6
2: Vincent Moore
3: 6 T9N R7E
4: Edgewood 7-1/2 (Albuquerque)
5: Edgewood area
6: barite
7: pits, shafts
9: Pennsylvanian Madera Limestone
12: Clippinger (1949)

Note: Los Angeles Wear is a measure of the resistance to abrasion of the aggregate. Soundness Loss is a measure of the resistance to weathering.

1: 1N.6E.22.144
2: Pit #753
3: 22 T1N R6E
4: Chupadera 7-1/2, (Socorro)
6: limestone
7: developed pit
8: produced unknown amount
9: Permian San Andres Limestone
10: excellent quality; 5 ft thickness; Los Angeles Wear, 26.0; Soundness Loss, 4.2; unlimited quantity
12: NMSHD (1975, p. 66, #2)

1: 1N.7E.31
2: Pit #754
3: N1/2 31 T1N R7E
4: Bigbee Draw 7-1/2 (Socorro)
6: limestone
7: pit or quarry
9: Permian San Andres Limestone
10: good quality; 10 ft thickness; unlimited quantity; Los Angeles Wear, upper 26.4, lower 22.4; Soundness Loss, 4.6
12: NMSHD (1975, p. 66, #2)

1: 1N.8E.33.433
2: Pit #5989
3: SW1/4 33 T1N R8E
4: Gran Quivira 7-1/2 (Socorro)
6: sand
7: developed pit
8: produced unknown amount
9: Permian San Andres Limestone
10: good quality; 5 ft thickness; 50,000 cu. yds.
12: NMSHD (1975, p. 66, #1); Hunt (1978)

1: 1N.9E.25.200
2: Pit #42
3: NE1/4 25 T1N R9E
4: Progresso Southwest 7-1/2 (Corona)
6: limestone
7: pit or quarry
9: Permian San Andres Limestone
10: excellent quality; 10 ft thickness; 300,000 cu. yds.; Los Angeles Wear, 30.4; Soundness Loss, 1.4
12: NMSHD (1975, p. 67, #3)

1: 1N.10E.23.100
2: Pit #2
3: NW1/4 23 T1N R10E
4: Progresso Southeast 7-1/2 (Corona)
6: limestone
7: pit or quarry
9: Permian San Andres Limestone
10: excellent quality; 15 ft thick; 500,000 cu. yds;
Los Angeles Wear, 21.6
12: NMSHD (1975, p. 67, #3)

1: 1N.12E.11.200
2: Pit #5729
3: NE1/4 11 T1N R12E
4: Cedarvale 7-1/2 (Corona)
6: caliche
7: developed pit
8: produced unknown amount
9: Quaternary pediment deposits
10: fair to poor quality; 3-6 ft thickness; 50,000 cu. yds.;
Los Angeles Wear cap, 33.6; soft caliche, 65.6
12: NMSHD (1975, p. 67, #1); Hunt (1977)

1: 1N.12E.24
2: Lenhart & Snodgrass Quarry
3: 24 T1N R12E
4: Cedarvale 7-1/2 (Corona)
6: flagstone
7: pit
8: produced in 1959 and 1960
9: Quaternary pediment deposit
12: MILS (1981); Hunt (1977)

1: 1N.13E.3
2: Pit
3: 3 T1N R13E (approximate)
4: Corona N 7-1/2 (Corona)
6: limestone
7: pit
9: Permian Yeso Formation
12: Hunt (1977)

1: 1N.13E.16
2: Pit
3: 16, 21 T1N R13E (approximate)
4: Corona N 7-1/2 (Corona)
6: sand and gravel
7: pit
9: Quaternary pediment deposit
12: Hunt (1977)

1: 1N.13E.23.200
2: Pit #877
3: NE1/4 23 T1N R13E
4: Corona North 7-1/2 (Corona)
6: gneissic granite
7: pit or quarry
9: Precambrian granite
10: fair quality; 35 ft thickness; 375,000 cu. yds;
Los Angeles Wear, 73.3; Soundness Loss, 6.7
12: NMSHD (1975)

1: 1N.13E.30.300
2: Pit #5732
3: SW1/4 30 T1N R13E
4: Corona North 7-1/2 (Corona)
6: limestone
7: developed pit
8: produced unknown amount
9: Permian San Andres Limestone
10: excellent quality; 15 ft thickness; 500,000 cu. yds.;
Los Angeles Wear, 26.4; Soundness Loss, 1.0
12: NMSHD (1975, p. 67, #1)

1: 1N.14E.18
2: Pit
3: 18 T1N R14E (approximate)
4: Camaleon Draw West 7-1/2, Corona N 7-1/2 (Corona)
6: sand and gravel
7: pit
9: Quaternary pediment deposit
12: Hunt (1977)

1: 1N.15E.21.400
2: Pit #132
3: SE1/4 21 T1N R15E
4: Camaleon Draw East 7-1/2 (Corona)
6: caliche
7: pit or quarry
9: Quaternary pediment deposits
10: fair quality; 1.5 ft thickness; 200,000 cu. yds.;
Los Angeles Wear, 43.2
12: NMSHD (1975, p. 68, #2)

1: 1N.15E.21.300
2: Pit #133
3: SW1/4 21 T1N R15E
4: Camaleon Draw West 7-1/2 (Corona)
6: caliche
7: pit or quarry
9: Quaternary pediment deposits
10: fair quality; 6 ft thickness; 200,000 cu. yds;
Los Angeles Wear, 36.0; Soundness Loss, 21.7
12: NMSHD (1975, p. 68, #2)

1: 2N.6E.7.321
2: Pit #794
3: SW1/4 7 T2N R6E
4: Abo 7-1/2 (Socorro)
6: intrusives
7: pit or quarry
9: Tertiary intrusive
10: fair quality; 12 ft thickness; 75,000 cu. yds;
Los Angeles Wear, 24.2; Soundness Loss, 8.9
12: NMSHD (1975, p. 66, #2)

1: 2N.6E.16.134
2: Pit #795
3: NW1/4 16 T2N R6E
4: Abo 7-1/2 (Socorro)
6: limestone
7: pit or quarry
9: Permian Yeso Limestone
10: good quality; 4 ft thickness; 100,000 cu. yds;
Los Angeles Wear, 27.0; Soundness Loss, 3.5
12: NMSHD (1974, p. 66, #2)

1: 2N.7E.14.142
2: Pit #5434
3: SE1/4 NW1/4 14 T2N R7E 34°23'59"N 106°11'18"W
4: Mesa Draw 7-1/2 (Socorro)
6: caliche and limestone
7: developed pit
8: produced unknown amount
9: Permian San Andres Limestone
10: good quality; 8 ft thickness; unlimited quantity
11: see Pit #5436
12: NMSHD (1975, p. 66, #1); MILS (1981); Hunt (1978)

1: 2N.7E.14.322
2: Pit #5436
3: SW1/4 14 T2N R7E
4: Mesa Draw 7-1/2 (Socorro)
6: caliche and limestone
7: developed pit
8: produced unknown amount
9: Permian San Andres Limestone
10: good quality; 8 ft thickness; unlimited quantity;
Los Angeles Wear, 38.8; Soundness Loss, 10.1
12: NMSHD (1975, p. 66, #1)

1: 2N.8E.19.211
2: Pit #5435
3: NE1/4 19 T2N R8E
4: Mesa Draw 7-1/2 (Socorro)
6: sand
7: developed pit
8: produced unknown amount
9: Permian San Andres Limestone
10: fair quality; 2-5 ft thickness; 50,000 cu. yds.
12: NMSHD (1975, p. 66, #1); Hunt (1978)

1: 2N.9E.1.100
2: Pit #31
3: NW1/4 1 T2N R9E
4: Progresso 7-1/2 (Corona)
6: limestone
7: pit or quarry
9: Permian San Andres Limestone
10: excellent quality; 15 ft thickness; 500,000 cu. yds.;
Los Angeles Wear, 35.2; Soundness Loss, 3.5
12: NMSHD (1975, p. 67, #2); Hunt (1977)

1: 2N.11E.3.300
2: Pit #5762
3: SW1/4 3 T2N R11E
4: Progresso Northeast 7-1/2 (Corona)
6: sand
7: developed pit
8: produced unknown amount
9: Quaternary eolian deposits
10: good quality; 4 ft thickness; 50,000 cu. yds.;
12: NMSHD (1975, p. 67, #1); Hunt (1977)

1: 2N.11E.4.200
2: Pit #59115
3: NE1/4 4 T2N R11E
4: Progresso Northeast 7-1/2 (Corona)
6: sand
7: developed pit
8: produced unknown amount
9: Quaternary eolian deposit
10: good quality; 5 ft thickness; 75,000 cu. yds.
12: NMSHD (1975, p. 67, #1); Hunt (1977)

1: 2N.11E.11
2: Pit
3: 11 T2N R11E (approximate)
4: Progresso Northeast 7-1/2 (Corona)
6: sand
7: pit
9: Quaternary pediment deposit
12: Hunt (1977)

1: 2N.11E.13
2: Pit
3: 13 T2N R11E (approximate)
4: Camaleon Draw West 7-1/2 (Corona)
6: sand and gravel
7: pit
9: Quaternary floodplain or stream-channel deposit
12: Hunt (1977)

1: 2N.11E.10.200
2: Pit #5734
3: NE1/4 10 T2N R11E
4: Progresso Northeast 7-1/2 (Corona)
6: sand
7: developed pit
8: produced unknown amount
9: Quaternary eolian deposits
10: good quality; 9 ft thickness; 75,000 cu. yds.
12: NMSHD (1975, p. 67, #1); Hunt (1977)

1: 2N.12E.15.300
2: Pit #5733
3: SW1/4 15 T2N R12E
4: Pino Mountain 7-1/2 (Corona)
6: caliche and gravel
7: developed pit
8: produced unknown amount
9: Quaternary pediment deposit
10: excellent quality; 10 ft thickness; 100,000 cu. yds.;
Los Angeles Wear, 20.8; Soundness Loss, 3.6
12: NMSHD (1975, p. 67, #1); Hunt (1977)

1: 2N.12E.24.200
2: Pit #35
3: NE1/4 24 T2N R12E
4: Pino Mountain 7-1/2 (Corona)
6: caliche and gravel
7: pit or quarry
9: Quaternary pediment deposit
10: good quality; 3 ft thickness; 250,000 cu. yds.;
Los Angeles Wear, 21.9
12: NMSHD (1975, p. 67, #2)

1: 2N.13E.35.300
2: Pit #36
3: SW1/4 35 T2N R13E
4: Corona North 7-1/2 (Corona)
6: limestone
7: pit or quarry
9: Permian Yeso Limestone
10: good quality; 5 ft thickness; 50,000 cu. yds.;
Los Angeles Wear, 41.2
12: NMSHD (1975, p. 67, #2)

1: 2N.13E.36.200
2: Pit #1
3: NE1/4 36 T2N R13E
4: Corona North 7-1/2 (Corona)
6: caliche
7: pit or quarry
9: Quaternary pediment deposits
10: good quality; 3 ft thickness; 30,000 cu. yds.;
Los Angeles Wear, 30.0; Soundness Loss, 13.4
12: NMSHD (1975, p. 67, #1)

1: 2N.14E.29.300
2: Pit #882
3: SW1/4 29 T2N R14E
4: Corona North 7-1/2 (Corona)
6: gneiss
7: pit or quarry
9: Precambrian
10: fair quality; 15 ft thickness; 7,000 cu. yds.;
Los Angeles Wear, 32.6; Soundness Loss, 3.2
12: NMSHD (1975, p. 68, #3)

1: 2N.14E.7.400
2: Pit #37
3: SE1/4 7 T2N R14E
4: Cedarvale Northeast 7-1/2 (Corona)
6: sand and gravel
7: pit or quarry
9: Quaternary pediment deposits
10: excellent quality; 20 ft thickness; 100,000 cu. yds.;
Los Angeles Wear, 33.6
12: NMSHD (1975, p. 67, #3)

1: 2N.14E.8.400
2: Pit #62
3: SE1/4 8 T2N R14E
4: Duran 7-1/2 (Corona)
6: caliche and gravel
7: pit or quarry
9: Quaternary pediment deposits
10: good quality; 10 ft thickness; 100,000 cu. yds.;
Los Angeles Wear, 34.4; Soundness Loss, 21.4
12: NMSHD (1975, p. 68, #2)

1: 2N.15E.10.400
2: Pit #136
3: SE1/4 10 T2N R15E
4: Duran Northeast 7-1/2 (Corona)
6: caliche
7: pit or quarry
9: Quaternary pediment deposits
10: excellent quality; 9 ft thickness; 550,000 cu. yds.;
Los Angeles Wear, 24.0; Soundness Loss, 11.8
12: NMSHD (1975, p. 68, #3)

1: 3N.5E.24.222
2: Pit #752
3: NE/14 24 T3N R5E
4: Abo 7-1/2 (Socorro)
6: gravel
7: pit or quarry
8: no production
9: Quaternary pediment deposits
10: fair quality; 2-3 ft thickness; unlimited quantity;
Los Angeles Wear, 31.8; Soundness Loss, 3.6;
Plasticity index 11
12: NMSHD (1975, p. 66, #2, incorrectly listed in Socorro County)

1: 3N.6E.1.233
2: Pit
3: 1 T3N R6E
4: Mountainair 15' (Belen)
6: sand and gravel
7: pit
9: Quaternary alluvial fan
12: Belen 1:100,000 topo map

1: 3N.6E.9.211
2: Pit #31
3: N1/2 9 T3N R6E
4: Abo 7-1/2 (Belen)
6: gravel
7: pit or quarry
9: Quaternary pediment deposits
10: good quality; 12-25 ft thickness; 100,000 cu. yds.; Los Angeles Wear, 28.4; Soundness Loss, 2.5
12: NMSHD (1975, p. 54, #2)

1: 3N.6E.19
2: Pit
3: 19 T3N R6E (approximate)
4: Abo 7-1/2 (Socorro)
6: sand and gravel
7: pit
9: Quaternary floodplain or stream-channel deposit
12: Hunt (1978)

1: 3N.6E.21.322
2: Pit #755
3: SW1/4 21 T3N R6E
4: Abo 7-1/2 (Socorro)
6: gravel
7: pit or quarry
9: Quaternary alluvial-fan deposits
10: good quality; 2-3 ft thickness; unlimited quantity; Los Angeles Wear, 31.0; Soundness Loss, 2.1; Plasticity index 8
12: NMSHD (1975, p. 66, #2); Hunt (1978)

1: 3N.6E.28.111
2: Pit #57115
3: NW1/4 NW1/4 28 T3N R6E 34°27'42"N 106°19'34"W
4: Abo 7-1/2 (Socorro)
6: gravel
7: developed pit
8: produced unknown amount
9: Quaternary pediment deposits
10: good quality; 6 ft thickness; 50,000 cu. yds.;
Los Angeles Wear, 28.8; Soundness Loss, 2.0;
Plasticity index 8-16
12: NMSHD (1975, p. 66, #1); MILS (1981); Hunt (1978)

1: 3N.6E.29.441
2: Pit #5511
3: SE1/4 29 T6E R3N
4: Abo 7-1/2 (Socorro)
6: gravel
8: production unknown
9: Quaternary pediment deposit
12: NMSHD (1975, p. 66)

1: 3N.6E.30.411
2: Pit #5695
3: SE1/4 30 T3N R6E
4: Abo 7-1/2 (Socorro)
6: gravel and sand
7: developed pit
8: produced unknown amount
9: Quaternary stream-channel or floodplain deposit
10: fair quality; 4 ft thickness;
Los Angeles Wear, 31.6; Soundness Loss, 7.3;
Plasticity index 12
12: NMSHD (1975, p. 66, #1); Hunt (1978)

1: 3N.6E.30.441
2: Pit #55100
3: SE1/4 30 T3N R6E
4: Abo 7-1/2 (Socorro)
6: gravel and sand
7: developed pit
8: produced unknown amount
9: Quaternary pediment deposits
10: fair quality; 4 ft thickness
11: see Pit #5695
12: NMSHD (1975, p. 68, #1)

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 1:  3N.7E.6
 2:  Pit
 3:  6 T3N R7E (approximate)
 4:  Mountainair 7-1/2 (Belen)
 6:  sand and gravel
 7:  pit
 9:  Quaternary alluvial-fan deposits
12:  Hunt (1978)


 1:  3N.7E.8.300
 2:  Pit #6053
 3:  SW1/4 8 T3N R7E  34o29'52"N 106o14'17"W
 4:  Mesa Draw 7-1/2 (Socorro)
 6:  gravel
 7:  developed pit
 8:  produced unknown amount
 9:  Quaternary alluvium
10:  good quality; 14 ft thickness; 100,000 cu. yds.;
     Los Angeles Wear, 32.4; Soundness Loss, 10.9
12:  NMSHD (1975, p. 54, #1); MILS (1981); Hunt (1978)


 1:  3N.7E.10
 2:  Pit
 3:  10 T3N R7E (approximate)
 4:  Mesa Draw 7-1/2
 6:  sand and gravel
 7:  pit
 9:  Quaternary alluvium
12:  Hunt (1978)


 1:  3N.7E.22.240
 2:  Pit
 3:  SE1/4 NE1/4 22 T3N R7E  34o29'22"N 106o11'31"W
 4:  Mesa Draw 7-1/2 (Socorro)
 6:  sand and gravel
 7:  pit
 9:  Quaternary alluvium
12:  MILS (1981); Hunt (1978)


 1:  3N.7E.35
 2:  Pit
 3:  35 T3N R7E (approximate)
 4:  Mesa Draw 7-1/2 (Socorro)
 6:  limestone
 7:  pit
 9:  Permian San Andres Limestone
12:  Hunt (1978)
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1: 3N.8E.10.323
2: Pit #5984
3: SW1/4 10 T3N R8E 34o29'54"N 106o5'52"W
4: Round Top 7-1/2 (Socorro)
6: gravel
7: developed pit
8: produced unknown amount
9: Quaternary pediment deposits
10: good quality; 10 ft thickness; 25,000 cu. yds.;
Los Angeles Wear, 39.6; Soundness Loss, 6.6;
Plasticity index 5
12: NMSHD (1975, p. 66, #1); MILS (1981)

1: 3N.9E.6,7
2: Pit #29
3: 6, 7 T3N R9E
4: Mountainair 15' (Belen)
6: limestone
7: pit or quarry
9: Permian San Andres Limestone
10: good quality; 6 ft thickness; unlimited quantity;
Los Angeles Wear, 32.8; Soundness Loss, 20.5
12: NMSHD (1975, p. 54, #2)

1: 3N.10E.9.400
2: Pit #32
3: SE1/4 9 T3N R10E
4: Progresso 7-1/2 (Corona)
6: sand and gravel
7: developed pit
8: produced unknown amount
9: Quaternary playa deposits
10: excellent quality; 10 ft thickness; 120,000 cu. yds.;
Los Angeles Wear, 32.0; Soundness Loss, 4.2
12: NMSHD (1975, p. 54, #2; p. 62, #2); Hunt (1977)

1: 3N.12E.14.100
2: Pit #34
3: NW1/4 14 T3N R12E
4: Pino Mountain 7-1/2 (Corona)
6: caliche
7: pit or quarry
9: Quaternary pediment deposits
10: fair quality; 4 ft thickness; 50,000 cu. yds.;
Los Angeles Wear, 42.4; Plasticity index, 8
12: NMSHD (1975, p. 67, # 2)

1: 3N.12E.34.300
2: Pit #3
3: SW1/4 34 T3N R12E
4: Pino Mountain 7-1/2 (Corona)
6: limestone
7: pit or quarry
9: Permian Yeso Limestone
10: fair quality; 5 ft thickness; 100,000 cu. yds.;
Los Angeles Wear, 40.4; Soundness Loss, 19.6
12: NMSHD (1975, p. 67, # 2)

1: 3N.14E.10.122
2: Pit #618
3: NW1/4 10 T3N R14E
4: Duran 7-1/2 (Vaughn)
6: limestone
7: pit or quarry
9: Permian Yeso Limestone
10: good quality; 5-8 ft thickness; 100,000 cu. yds.;
Los Angeles Wear, 16.9; Soundness Loss, 2.6
12: NMSHD (1975, p. 56, #3)

1: 3N.14E.11.300
2: Pit #880
3: SW1/4 11 T3N R14E
4: Duran 7-1/2 (Corona)
6: limestone
7: pit or quarry
9: Permian Yeso Limestone
10: good quality; 4 ft thickness; 200,000 cu. yds. plus;
Los Angeles Wear, 18.0; Soundness Loss, 2.3
12: NMSHD (1975, p. 68, #3)

1: 3N.14E.36
2: Pit #61
3: S1/2 36 T3N R14E
4: Duran 7-1/2 (Corona)
6: caliche
7: pit or quarry
9: Quaternary pediment deposits
10: fair quality; 7 ft thickness; 100,000 cu. yds. est.;
Los Angeles Wear, 42.0
12: NMSHD (1975, p. 68, #2)

1: 3N.15E.10.300
2: Pit #881
3: SW1/4 10 T3N R15E
4: Duran Northeast 7-1/2 (Corona)
6: diorite
7: pit or quarry
9: Tertiary intrusive
10: fair quality; 8 ft thickness; 10,000 cu. yds.;
Los Angeles Wear, 18.2; Soundness Loss, 5.5
12: NMSHD (1975, p. 68, #3)

1: 4N.5E.17.400
2: Pit #709
3: SE1/4 17 T4N R5E
4: Torreon 15' (Belen)
6: quartzite
7: pit or quarry
9: Precambrian
10: excellent quality; 100 ft thickness; 150,000 cu. yds.;
Los Angeles Wear, 22.8; Soundness Loss, 1.8
12: NMSHD (1975, p. 54, #3)

1: 4N.5E.28.444
2: Pit
3: SE1/4 28 T4N R5E
4: Torreon 15' (Belen)
6: sand and gravel
7: pit
9: Permian Abo Formation
12: Belen 1:100,000 topographic map

1: 4N.6E.16.444
2: Pit
3: 16 T4N R6E
4: Mountainair 15' (Belen)
6: sand and gravel
7: pit
9: Quaternary alluvial-fan deposit
12: Belen 1:100,000 topo map

1: 4N.6E.17.444
2: Pit
3: 17 T4N R6E
4: Torreon 15' (Belen)
6: materials
7: developed pit
8: materials
9: Quaternary pediment
12: USGS topographic map

1: 4N.6E.33.224
2: Pit #25
3: E1/2 33 T4N R6E
4: Torreon 15' (Belen)
6: sand and gravel
7: pit or quarry
9: Quaternary pediment deposits
10: good quality; 15-20 ft thickness; unlimited quantity; Los Angeles Wear, 27.6; Soundness Loss, 12.2; Plasticity index, 8
12: NMSHD (1975, p. 54, #2)

1: 4N.7E.6.444
2: Pit
3: 6 T4N R7E
4: Mountainair 15' (Belen)
6: sand and gravel
7: pit
9: Quaternary floodplain or stream-channel deposit
12: Hunt (1978)

1: 4N.7E.27
2: Pit
3: 27 T4N R7E
4: Mountainair 15' (Belen)
6: sand and gravel
7: pit
9: Quaternary alluvial-fan deposits
12: Hunt (1978)

1: 4N.7E.29
2: Pit
3: 29 T4N R7E 34°32'16"N 106°14'14"W
4: Mountainair 15' (Belen)
6: sand and gravel
12: MILS (1981)

1: 4N.7E.29.300
2: Mountainair pit
3: SW1/4 29 T4N R7E 34°32'16"N 106°14'14"W
4: Mountainair 15' (Belen)
6: sand and gravel
7: pit
9: Quaternary stream-channel or floodplain deposit
12: MILS (1981); Hunt (1978)

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 1:  4N.8E.2
 2:  Pit
 3:  2 T4N R8E  34o36'16"N 106o4'50"W
 4:  Mountainair 15' (Belen)
 6:  sand and gravel
12:  MILS (1981)


 1:  4N.8E.2.100
 2:  Pit
 3:  NW1/4 2 T4N R8E  34o36'27"N 106o4'56"W
 4:  Mountainair 15' (Belen)
 6:  sand and gravel
12:  MILS (1981)


 1:  4N.8E.16
 2:  Bronco Pit (Pit #22)
 3:  E1/2 16 T4N R8E  34o34'25"N 106o6'28"W
 4:  Mountainair 15' (Belen)
 6:  sand and gravel
 7:  pit or quarry
 9:  Quaternary pediment deposits
10:  good quality; 10 ft thickness; 150,000 cu. yds.;
     Los Angeles Wear, 28.8; Soundness Loss, 4.8; Plasticity
     index, 8-10
12:  NMSHD (1975, p. 54, #2); MILS (1981)


 1:  4N.8E.26.443
 2:  Pit
 3:  26 T4N R8E
 4:  Mountainair 15' (Belen)
 6:  materials
 7:  developed pit
 8:  materials
 9:  Quaternary alluvium
12:  USGS topographic map


 1:  4N.8E.27.441
 2:  Pit #23
 3:  S1/2 27 T4N R8E
 4:  Mountainair 15' (Belen)
 6:  sand and gravel
 7:  pit or quarry
 9:  Quaternary pediment deposit
10:  fair quality; 6 ft thickness; 50,000 cu. yds.;
     Los Angeles Wear, 31.6; Soundness Loss, 9.2;
     Plasticity index, 8
12:  NMSHD (1975, p. 54, #2)
```

1: 4N.9E.3
2: Pit
3: 3 T4N R9E (approximate)
4: Laguna del Perro South 7-1/2 (Vaughn)
6: sand and gravel
7: pit
9: Quaternary playa deposit
12: Hunt (1977)

1: 4N.9E.6.300
2: Pit #57116, 5611
3: SW1/4 6 T4N R9E
4: Mountainair 15' (Belen)
6: sand
7: developed pit
8: produced unknown amount
9: Quaternary bolson deposits
10: fair quality; 7 ft thickness; 20,000 cu. yds.
12: NMSHD (1975, p. 54, #1); Hunt (1978)

1: 4N.9E.10
2: Pit
3: 10 T4N R9E (approximate)
4: Laguna del Perro South 7-1/2 (Vaughn)
6: sand and gravel
7: pit
9: Quaternary playa deposit
12: Hunt (1977)

1: 4N.10E.27.144
2: Pit #768
3: 27 T4N R10E
4: Laguna del Perro South 7-1/2 (Vaughn)
6: granite
7: pit or quarry
9: Precambrian
10: good quality; 35 ft thickness; unlimited quantity;
Los Angeles Wear, 36.1; Soundness Loss, 1.6
12: NMSHD (1975, p. 55, #3)

1: 4N.15E.34.444
2: Pit #769
3: SE1/4 34 T4N R15E
4: Tejon 7-1/2 (Vaughn)
6: diorite
7: pit or quarry
9: Tertiary intrusive
10: poor quality; 11 ft thickness; 150,000 cu. yds.;
Los Angeles Wear, 57.2; Soundness Loss, 27.1
12: NMSHD (1975, p. 56, #4)

1: 5N.5E.7.300
2: Pit #708
3: SW1/4 7 T5N R5E
4: Capilla Peak 7-1/2 (Belen)
6: granitic schist
7: pit or quarry
9: Precambrian
10: good quality; 85 ft thickness; unlimited quantity
Los Angeles Wear, 27.5; Soundness Loss, 4.8
12: NMSHD (1975, p. 54, #3)

1: 5N.6E.4.241
2: Pit
3: 4 T5N R6E
4: Torreon 7-1/2 (Belen)
6: materials
7: developed pit
8: materials
9: Quaternary alluvium and pediment gravels
12: USGS topographic map

1: 5N.6E.20.100
2: Pit #15
3: 20 T5N R6E (unsurveyed)
4: Torreon 15' (Belen)
6: gravel
7: pit or quarry
9: Quaternary pediment deposits
10: poor quality; 12 ft thickness; 300,000 cu. yds.;
Los Angeles Wear, 45.2; Soundness Loss, 19.9
12: NMSHD (1975, p. 54, #1)

1: 5N.7E.29.441
2: Jack's Pit (Pit #19)
3: SE1/4 29 T5N R7E 34o37'26"N 106o13'20"W
4: Mountainair 15' (Belen)
6: sand and gravel
7: pit or quarry
9: Quaternary pediment deposits
10: good quality; 6 ft thickness; 20,000 cu. yds.;
Los Angeles Wear, 29.6; Soundness Loss, 2.3
12: NMSHD (1975, p. 54, #2); MILS (1981)

1: 5N.7E.29
2: Pit
3: 29 T5N R7E 34o37'26"N 106o13'20"W
4: Mountainair 15' (Belen)
6: sand and gravel
9: Quaternary pediment deposits
12: MILS (1981)

```
 1:  5N.7E.33.111
 2:  Pit
 3:  33 T5N R7E
 4:  Mountainair 15' (Belen)
 6:  sand and gravel
 7:  pit
 9:  Quaternary pediment deposit
12:  Belen 1:100,000 topo


 1:  5N.8E.17
 2:  Pit
 3:  17 T3N R8E (approximate)
 4:  Mountainair 15' (Belen)
 6:  sand and gravel
 7:  pit
 9:  Quaternary alluvial-fan deposit
12:  Hunt (1978)


 1:  5N.10E.12.412
 2:  Pit #766
 3:  SE1/4 12 T5N R10E
 4:  Lucy 7-1/2 (Vaughn)
 6:  sand and gravel
 7:  pit or quarry
 9:  Quaternary bolson deposit
10:  good quality; 13 ft thickness; 300,000 cu. yds.;
     Los Angeles Wear, 44.3; Soundness Loss, 5.1
12:  NMSHD (1975, p. 55, #3)


 1:  5N.10E.25.342
 2:  Pit #767
 3:  SW1/4 25 T5N R10E
 4:  Lucy 7-1/2 (Vaughn)
 6:  sand and gravel
 7:  pit or quarry
 9:  Quaternary bolson deposits
10:  good quality; 10 ft thickness; 255,000 cu. yds.;
     Los Angeles Wear, 42.0; Soundness Loss, 1.9
12:  NMSHD (1975, p. 55, #3); Hunt (1977)


 1:  5N.12E.31.210 (approx.)
 2:  Pit #765
 3:  NE1/4 31 T5N R12E
 4:  Negra Southwest 7-1/2 (Vaughn)
 6:  gravel
 7:  pit or quarry
 9:  Quaternary bolson deposits
10:  fair quality; 10 ft thickness; 75,000 cu. yds.;
     Los Angeles Wear, 26.6; Soundness Loss, 4.1
12:  NMSHD (1975, p. 55, #3)
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1: 5N.13E.8.422
2: Pit #764
3: E1/2 8 T5N R13E 34°40'24"N 105°34'27"W
4: Negra 7-1/2 (Vaughn)
6: caliche
7: pit or quarry
9: Quaternary pediment deposits
10: good to fair quality; 2-3 ft thickness; 50,000-100,000 cu. yds.; Los Angeles Wear, 29.6 calcap, softened cal, 34.2; Soundness Loss calcap, 9.5, softened cal, 22.5
12: NMSHD (1975, p. 55, #3); MILS (1981)

1: 5N.13E.8.333
2: Pit
3: 18 T5N R13E
4: Negra 7-1/2 (Vaughn)
6: materials pit
7: pit
9: Quaternary deposits
12: Ft. Sumner 1:250,000 scale map

1: 5N.13E.18.100
2: Rock Products Company of New Mexico Quarry
3: NW1/4 18 T5N R13E 34°40'00"N., 105°36'30"W
4: Negra 7-1/2 (Vaughn)
5: Pedernal area
6: micaceous felspathic hornfels
7: developed quarry with crusher
8: exact production unknown but at least 50,000 tons
9: Precambrian undivided
10: Precambrian aged micaceous felspathic hornfels crops out in a series of low hills surrounding the property.
11: Quarry was opened in 1984 for the production of railroad ballast. Finished products included 2-3/4 in base course and crusher fines. Material is being produced for sale to both Santa Fe and Southern Pacific Railroads. Operator is Rock Products Company of New Mexico (an affiliate of Rocky Products Company, P.O. Box 1057, Susanville, California 96130). Land status is private surface over private minerals.
12: Ralph Conway (PC, 5/84)

1: 5N.14E.6.133
2: Pit
3: 6 T5N R14E 34°41'22"N 105°30'1"W
4: Negra 7-1/2 (Vaughn)
6: sand and gravel
12: MILS (1981)

1: 5N.14E.6.130
2: Pit
3: 6 T5N R14E 34°41'23"N 105°29'58"W
4: Encino 7-1/2 (Vaughn)
6: sand and gravel
12: MILS (1981)

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 1:  5N.14E.9.334
 2:  Pit
 3:  9 T5N R14E  34o40'01"N 105o27'42"W
 4:  Encino 7-1/2 (Vaughn)
 6:  sand and gravel
12:  MILS (1981)

 1:  5N.14E.29.433
 2:  Pit #617
 3:  SE1/4 29 T5N R14E
 4:  Encino 7-1/2 (Vaughn)
 6:  sand and gravel
 7:  pit or quarry
10:  good quality; 15 ft thickness; 50,000 cu. yds.;
     Los Angeles Wear, 25.6; Soundness Loss, 13.0
12:  NMSHD (1975, p. 56, #2)

 1:  5N.14E.32.432
 2:  Dunlam Mine (Dunlap)
 3:  32 T5N R14E   34o36'40"N 105o28'30"W
 4:  Dunlap Ranch 7-1/2 (Vaughn)
 6:  sand and gravel
12:  MILS (1981)

 1:  6N.8E.15.432
 2:  Pit #710
 3:  S1/2 15 T6N R8E
 4:  Mountainair 15' (Belen)
 6:  sand and gravel
 7:  pit or quarry
 9:  Quaternary playa deposit
10:  good quality; 6 ft thickness; 40,000 cu. yds.;
     Los Angeles Wear, 24.0; Soundness Loss, 9.8;
     Plasticity index 6
12:  NMSHD (1975, p. 54, #3); Hunt (1978)

 1:  6N.8E.22
 2:  Pit
 3:  22 T6N R8E
 4:  Mountainair 15' (Belen)
 6:  sand and gravel
 7:  pit
 9:  Quaternary playa deposit
12:  Hunt (1978)


 1:  6N.8E.31.232
 2:  Pits
 3:  31 T6N R8E
 4:  Manzano 7-1/2 (Belen)
 6:  materials
 7:  developed pit
 8:  materials
 9:  Quaternary alluvium
12:  USGS topographic maps
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1: 6N.8E.33.432
2: Pit
3: 33 T6N R8E
4: Mountainair 15' (Belen)
6: materials
7: developed pit
8: materials
9: Quaternary lake deposits and alluvium
12: USGS topographic maps

1: 6N.12E.4.421
2: Pit #763
3: SE1/4 4 T6N R12E
4: Pedernal Mountain 7-1/2 (Vaughn)
6: granitic gneiss
7: pit or quarry
9: Precambrian
10: fair quality; 25 ft thickness; unlimited quantity; Los Angeles Wear, 15.5; Soundness Loss, 1.2
12: NMSHD (1975, p. 55, #3)

1: 6N.13E.9.141
2: Pit
3: SE1/4 NW1/4 9 T6N R13E 34o45'53"N 105o33'59"W
4: North Lucy 7-1/2 (Vaughn)
6: sand and gravel
12: MILS (1981)

1: 6N.13E.36.223
2: Pit
3: 36 T6N R13E 34o42'28"N 105o30'17"W
4: Negra 7-1/2 (Vaughn)
6: sand and gravel
12: MILS (1981)

1: 6N.14E.6.423
2: Pit #624
3: SE1/4 6 T6N R14E
4: Santo Nino Canyon 7-1/2 (Vaughn)
6: limestone
7: pit or quarry
9: Permian Yeso Limestone
10: good quality; 5 ft thickness; 500,000 cu. yds.; Los Angeles Wear, 33.1; Soundness Loss, 4.2
12: NMSHD (1975, p. 56, #3)

1: 7N.5E.3.300
2: Pit #705
3: SW1/4 3 T7N R5E (unsurveyed)
4: Bosque Peak 7-1/2 (Belen)
6: limestone
7: pit or quarry
9: Pennsylvanian Sandia Formation
10: good quality; 45 ft thickness; 400,000 cu. yds.;
Los Angeles Wear, 22.3; Soundness Loss, 7.1
12: NMSHD (1975)

1: 7N.5E.15.100
2: Pit #706
3: NW1/4 15 T7N R5E (unsurveyed)
4: Bosque Peak 7-1/2 (Belen)
6: granite
7: pit or quarry
9: Precambrian
10: fair quality; 100 ft thickness; 1,000,000 cu. yds.;
Los Angeles Wear, 27.8; Soundness Loss, 8.4
12: NMSHD (1975, p. 54, #2)

1: 7N.6E.36.441
2: Pit
3: 36 T7N R6E
4: Tajique 7-1/2 (Belen)
6: materials
7: developed pit
8: materials (limestone)
9: Pennsylvanian Madera Group
12: USGS topographic maps

1: 7N.7E.16.333
2: Pit #56106, 56105
3: SW1/4 16 T7N R7E
4: Milbourn Ranch 7-1/2 (Belen)
6: limestone
7: pit
9: Pennsylvanian Madera Limestone
10: good quality; 14 ft thickness; unlimited quantity;
Los Angeles Wear, 28.8; Soundness Loss, 2.7
12: NMSHD (1975, p. 54, #1); Hunt (1978)

1: 7N.7E.24.114
2: Pit #6445
3: NW1/4 24 T7N R7E
4: Milbourn Ranch 7-1/2 (Belen)
6: limestone
7: pit
9: Pennsylvanian Madera Limestone
10: good quality; 14 ft thickness; 600,000 cu. yds.; Los Angeles Wear, 30.0; Soundness Loss, 1.16
12: NMSHD (1975, p. 54, #1); Hunt (1978)

1: 7N.7E.29.112
2: Pit
3: 29 T7N R7E
4: Milbourn Ranch 7-1/2 (Belen)
6: materials
7: developed pit
8: materials
9: Quaternary alluvium and Pennsylvanian Madera Group
12: USGS topographic maps

1: 7N.8E.3.433
2: Pit #57123, 57122
3: SE1/4 3 T7N R8E
4: Estancia 7-1/2 (Belen)
6: coarse sand
7: developed pit
8: produced unknown amount
9: Quaternary alluvial fan-deposits
10: good quality; 5 ft thickness; 5,000 cu. yds.; Plasticity index, 0-11
12: NMSHD (1975, p. 54, #1); Hunt (1978)

1: 7N.8E.13.433
2: Pit
3: 13 T7N R8E
4: Estancia 15' (Belen)
6: materials
7: developed pit
8: materials
9: Quaternary alluvium and lake deposits
12: USGS topographic maps

1: 7N.8E.15.432
2: Pit
3: 15 T7N R8E
4: Estancia 15' (Belen)
6: materials
7: developed pit
8: materials
9: Quaternary alluvium
12: USGS topographic maps

1: 7N.10E.9.112
2: Pit #758
3: NW1/4 9 T7N R10E
4: Lobo Hill 7-1/2 (Vaughn)
6: blow sand
7: pit or quarry
9: Quaternary eolian deposits
10: good quality; 8 ft thickness; 50,000 cu. yds.
12: NMSHD (1975, p. 55, #2); Hunt (1978)

1: 7N.11E.24.223
2: Pit #759
3: NE1/4 24 T7N R11E
4: Pedernal Mountain 7-1/2 (Vaughn)
6: gravel
7: pit or quarry
9: Quaternary pediment deposits
10: good quality; 2 ft thickness; 100,000 cu. yds.;
Los Angeles Wear, 20.2; Soundness Loss, 4.9
12: NMSHD (1975, p. 55, #2)

1: 7N.12E.1.243
2: Pit #5922
3: NE1/4 1 T7N R12E
4: North Lucy 7-1/2 (Vaughn)
6: quartzite
7: developed pit
8: produced unknown amount
9: Precambrian quartzite
10: excellent quality; 40 ft thickness; 500,000 cu. yds.;
Los Angeles Wear, 24.0; Soundness Loss, 0.7
12: NMSHD (1975, p. 55, #1); Hunt (1977)

1: 7N.13E.6.213
2: Pit
3: NW1/4 NE1/4 6 T7N R13E 34°52'4"N 105°35'53"W
4: North Lucy 7-1/2 (Vaughn)
6: sand and gravel
12: MILS (1981)

1: 7N.13E.25.111
2: Pit
3: NW1/4 NW1/4 25 T7N R13E 34°48'42"W 105°31'00"W
4: North Lucy 7-1/2 (Vaughn)
6: sand and gravel
12: MILS (1981)

1: 7N.13E.27.123
2: Pit #761
3: NE1/4 27 T7N R13E 34°48'42"N 105°32'33"W
4: North Lucy 7-1/2 (Vaughn)
6: sand and gravel
7: pit or quarry
9: Quaternary gravel deposits
10: excellent quality; 20 ft thickness; 300,000 cu. yds.; Los Angeles Wear, 24.8; Soundness Loss, 7.1
12: NMSHD (1975, p. 55, #2); MILS (1981)

1: 7N.13E.30.214
2: Pit #760
3: NE1/4 30 T7N R13E
4: North Lucy 7-1/2 (Vaughn)
6: gravel
7: pit or quarry
9: Quaternary pediment deposits
10: good quality; 1-8 ft thickness; 200,000 cu. yds.; Los Angeles Wear, 26.0; Soundness Loss, 9.7
12: NMSHD (1975, p. 55, #2)

1: 7N.13E.33.421
2: Pit #762
3: E1/2 33 T7N R13E
4: North Lucy 7-1/2 (Vaughn)
6: limestone
7: pit or quarry
9: Permian Yeso Limestone
10: good quality; 12 ft thickness; 50,000 cu. yds.; Los Angeles Wear, 41.2; Soundness Loss, 18.1
12: NMSHD (1975, p. 55, #2)

1: 7N.14E.29.433
2: Pit #57113
3: SE1/4 29 T7N R14E
4: Santo Niño Canyon 7-1/2 (Vaughn)
6: blow sand
7: developed pit
8: produced unknown amount
9: Quaternary eolian deposits
10: fair quality; 5 ft thickness; 100,000 cu. yds.
12: NMSHD (1975, p. 56, #1)

1: 7N.14E.30.414
2: Pit #625
3: SE1/4 30 T7N R14E
4: Santo Niño Canyon 7-1/2 (Vaughn)
6: sand and gravel
7: pit or quarry
9: Quaternary alluvium
10: good quality; 6 ft thickness; 200,000 cu. yds.; Los Angeles Wear, 26.7; Soundness Loss, 5.5
12: NMSHD (1975, p. 56, #3)

1: 7N.14E.35
2: Pit
3: 35 T7N R14E (approximate)
4: Santo Niño Canyon 7-1/2 (Vaughn)
6: sand and gravel
7: pit
9: Quaternary deposit
12: Hunt (1977)

1: 8N.8E.1.240
2: Pit #9 (Mendonca)
3: SE1/4 NE1/4 1 T8N R8E 34o56'52"N 106o2'48"W
4: Estancia 15' (Belen)
6: coarse sand
7: pit or quarry
9: Quaternary stream-channel or floodplain deposits
10: fair quality; 10 ft thickness; 30,000 cu. yds.; Los Angeles Wear, 23.8; Soundness Loss, 3.8
12: NMSHD (1975, p. 54, #1); MILS (1981); Hunt (1978)

1: 8N.8E.12.322
2: Pit
3: 12 T8N R8E
4: Estancia 15' (Belen)
6: materials
7: developed pit
8: materials
9: Quaternary alluvium
12: USGS topographic maps

1: 8N.8E.16.133
2: Pit #6444
3: NW1/4 16 T8N R8E
4: Estancia 15' (Belen)
6: limestone
7: developed pit
8: produced unknown amount
9: Pennsylvanian Madera Limestone
10: good quality; 5 ft thickness; 300,000 cu. yds.;
Los Angeles Wear, 28.0; Soundness Loss, 8.6
12: NMSHD (1975, p. 54, #1); Hunt (1978)

1: 8N.8E.36.123
2: Pit
3: 36 T8N R8E
4: Estancia 15' (Belen)
6: materials
7: developed pit
8: materials
9: Quaternary alluvium and lake deposits
12: USGS topographic maps

1: 8N.10E.7.111
2: Pit #5911
3: NW1/4 7 T8N R10E
4: Lobo Hill 7-1/2 (Vaughn)
6: quartzite
7: developed pit
8: produced unknown amount
9: Precambrian
10: excellent quality; 30 ft thickness; 300,000 cu. yds.;
Los Angeles Wear, 20.0; Soundness Loss, 0.3
12: NMSHD (1975, p. 55, #1)

1: 8N.10E.22.123
2: Pit
3: NW1/4 22 T8N R10E 34°54'8"N 105°51'59"W
4: Lobo Hill 15'
6: sand and gravel
12: MILS (1981)

1: 8N.10E.27.122
2: Pit
3: NE1/4 NW1/4 27 T8N R10E 34°53'53"N 105°51'52"W
4: Lobo Hill 15'
6: sand and gravel
12: MILS (1981)

1: 8N.12E.13.421
2: Pit
3: SE1/4 13 T8N R12E 34°55'10"N 105°36'48"W
4: Waller Ranch 7-1/2 (Vaughn)
6: sand and gravel
12: MILS (1981)

1: 8N.13E.31.341
2: Pit
3: SE1/4 SW1/4 31 T8N R13E 34°52'22"N 105°36'6"W
4: North Lucy 7-1/2 (Vaughn)
6: sand and gravel
12: MILS (1981)

1: 8N.14E.4.434
2: Pit #5740
3: SE1/4 4 T8N R14E 34°56'49"N 105°27'3"W
4: Palma 7-1/2 (Vaughn)
6: limestone
7: developed pit
8: produced unknown amount
9: Permian San Andres Limestone
10: good quality; 15 ft thickness; 100,000 cu. yds.;
Los Angeles Wear, 26.8; Soundness Loss, 2.7
12: NMSHD (1975, p. 56, #1); MILS (1981)

1: 8N.14E.8.441
2: Pit #614
3: SE1/4 8 T8N R14E
4: Palma 7-1/2 (Vaughn)
6: limestone
7: developed pit
8: produced unknown amount
9: Permian San Andres Limestone
10: good quality; 15 ft thickness; 200,000 cu. yds.;
Los Angeles Wear, 29.2; Soundness Loss, 9.7
12: NMSHD (1975, p. 56, #2)

1: 9N.7E.1.300
2: Pit #6246
3: SW1/4 1 T9N R7E
4: Edgewood 7-1/2 (Albuquerque)
6: limestone
7: developed pit
8: produced unknown amount
9: Pennsylvanian Madera Limestone
10: excellent quality; 30 ft thickness; 660,000 cu. yds.;
Los Angeles Wear, 24.0; Soundness Loss, 1.1;
Plasticity index 7
12: NMSHD (1975, p. 42, #2)

1: 9N.7E.11
2: Pit
3: 11 T9N R7E (approximate)
4: Edgewood 7-1/2 (Albuquerque)
6: sand and gravel
7: pit
9: Quaternary stream-channel or floodplain deposits
12: Hunt (1978)

1: 9N.8E.5.300
2: Pit #689
3: SW1/4 5 T9N R8E 35°1'38"N 106°6'52"W
4: Edgewood 15' (Albuquerque)
6: sand and gravel
7: pit or quarry
9: Quaternary stream-channel or floodplain deposits
10: good quality; 10 ft thickness; 450,000 cu. yds.; Los Angeles Wear, 18.1; Soundness Loss, 6.2; Plasticity index 9
12: NMSHD (1975, p. 42, #5); MILS (1981); Hunt (1978)

1: 9N.9E.2
2: Pit
3: 2 T9N R9E (approximate)
4: Stanley 15' (Villanueva)
6: sand and gravel
7: pit
9: Quaternary floodplain or channel deposit
12: Hunt (1977)

1: 9N.9E.4.200
2: Pit #647
3: NE1/4 4 T9N R9E
4: Stanley 15' (Villanueva)
6: sand
7: pit or quarry
9: Quaternary floodplain or channel deposits
10: excellent quality; 6 ft thickness; 150,000 cu. yds.
12: NMSHD (1975, p. 43, #4); Hunt (1977)

1: 9N.9E.13.300
2: Pit #5914
3: SW1/4 13 T9N R9E
4: Stanley 15'
6: sand and gravel
7: developed pit
8: produced unknown amount
9: Quaternary bolson deposits
10: fair quality; 10 ft thickness; 500,000 cu. yds.; Los Angeles Wear, 37.2; Soundness Loss, 6.7
12: NMSHD (1975, p. 43, #1, p. 55, #1)

1: 9N.9E.28.400
2: Pit
3: SE1/4 28 T9N R9E 34°58'25"N 105°59'7"W
4: Lobo Hill 15' (Vaughn)
6: sand and gravel
12: MILS (1981)

1: 9N.9E.34.211
2: Pit #5916
3: NW1/4 NE1/4 33 T9N R9E 34°58'4"N 105°59'8"W
4: Lobo Hill 15' (Vaughn)
6: sand and gravel
7: developed pit
8: produced unknown amount
9: Precambrian
10: good quality; 10 ft thickness; 200,000 cu. yds.; Los Angeles Wear, 25.6; Soundness Loss, 4.5
12: NMSHD (1975, p. 55, #1); MILS (1981)

1: 9N.9E.33.200
2: Pit #6443
3: NE1/4 33 T9N R9E
4: Lobo Hill 15' (Vaughn)
6: sand and gravel
7: developed pit
8: produced unknown amount
9: Quaternary bolson deposit
10: good quality; 10 ft thickness; 200,000 cu. yds.; Los Angeles Wear, 31.6; Soundness Loss, 1.73
12: NMSHD (1975, p. 55, #2); MILS (1981)

1: 9N.10E.1
2: Pit
3: 1 T9N R10E (approximate)
4: Stanley 15' (Villanueva)
6: sand and gravel
7: pit
9: Permian Yeso Formation
12: Hunt (1977)

1: 9N.10E.2
2: Pit
3: 2 T9N R10E (approximate)
4: Stanley 15' (Villanueva)
6: sand and gravel
7: pit
9: Permian Yeso Formation
12: Hunt (1977)

1: 9N.10E.9,16
2: Pit
3: 9, 16 T9N R10E (approximate)
4: Stanley 15' (Villanueva)
6: sand and gravel
7: pit
9: Quaternary floodplain or channel deposit
12: Hunt (1977)

1: 9N.10E.13.400
2: Pit
3: SE1/4 13 T9N R10E 35o00'11"N 105o49'30"W
4: Stanley 15' (Villanueva)
6: sand and gravel
12: MILS (1981)

1: 9N.10E.14.100
2: Pit #5583
3: NW1/4 14 T9N R10E
4: Stanley 15' (Villanueva)
6: caliche
7: developed pit
8: produced unknown amount
9: Quaternary pediment deposit
10: fair quality; 15 ft thickness; 170,000 cu. yds.;
Los Angeles Wear, 27.2
12: NMSHD (1975, p. 43, #1)

1: 9N.10E.23.420
2: Pit #5602
3: NE1/4 SE1/4 23 T9N R10E 34°59'15"N 105°50'36"W
4: Lobo Hill 15' (Vaughn)
6: sand and gravel
7: developed pit
8: produced unknown amount
9: Quaternary alluvium
10: good quality; 5-15 ft thickness; 60,000 cu. yds.; Los Angeles Wear, 36.2; Soundness Loss, 9.6
12: NMSHD (1975, p. 55, #1); MILS (1981)

1: 9N.10E.23.430
2: Pit #5603
3: SE1/4 23 T9N R10E
4: Lobo Hill 15' (Vaughn)
6: sand and gravel
7: developed pit
8: produced unknown amount
9: Quaternary alluvium
10: fair quality; 5-15 ft thickness; 70,000 cu. yds.; Los Angeles Wear, 38.0; Soundness Loss, 7.2
12: NMSHD (1975, p. 55, #1)

1: 9N.10E.27.333
2: Pit #5910
3: SW1/4 27, SE1/4 28 T9N R10E
4: Lobo Hill 15' (Vaughn)
6: sand and gravel
7: pit or quarry
9: Quaternary alluvium
10: fair quality; 15 ft thickness; 200,000 cu. yds.; Los Angeles Wear, 33.6; Soundness Loss, 6.1
12: NMSHD (1975, p. 55, #1)

1: 9N.10E.30
2: Pit
3: 30 T9N R10E (approximate)
4: Lobo Hill 7-1/2 (Vaughn)
6: sand and gravel
7: pit
9: Quaternary playa deposit
12: Hunt (1977)

1: 9N.11E.3,4
2: Pit
3: 3, 4 T9N R11E (approximate)
4: Clines Corner 7-1/2 (Villanueva)
6: sand and gravel
7: pit
9: Quaternary floodplain or channel deposit
12: Hunt (1977)

1: 9N.11E.12
2: Pit
3: 12 T9N R11E (approximate)
4: Clines Corner 7-1/2 (Villanueva)
6: sand and gravel
7: pit
9: Quaternary alluvium
12: Hunt (1977)

1: 9N.11E.14.310
2: Pit
3: NW1/4 SW1/4 14 T9N R11E 35o00'12"N 105o44'55"W
4: Clines Corner 7-1/2 (Villanueva)
6: sand and gravel
9: Quaternary alluvium
12: MILS (1981)

1: 9N.11E.15.240
2: Pit #5561
3: SE1/4 NE1/4 15 T9N R11E 35o00'26"N 105o45'5"W
4: Stanley 15' (Villanueva)
6: sand and gravel--conglomerate
7: developed pit
9: Quaternary pediment deposits
10: excellent quality; 13 ft thickness; 145,000 cu. yds.; Los Angeles Wear, 32.0
12: NMSHD (1974, p. 43, #1); MILS (1981); Hunt (1977)

1: 9N.11E.18.300
2: Pit
3: SW1/4 18 T9N R11E 35o00'6"N 105o48'50"W
4: Stanley 15' (Villanueva)
6: sand and gravel
12: MILS (1981)

1: 9N.11E.23.300
2: Pit #5579
3: SW1/4 23 T9N R11E 34059'13"N 105044'44"W
4: Rock Lake 7-1/2 (Vaughn)
6: limestone
7: developed pit
8: produced unknown amount
9: Permian San Andres Limestone
10: excellent quality; 12 ft thickness; 100,000 cu. yds.;
Los Angeles Wear, 24.0; Soundness Loss, 9.4
12: NMSHD (1975, p. 55, #1); MILS (1981)

1: 9N.11E.26.100
2: Pit #6119
3: NW1/4 26 T9N R11E 34058'53"N 105044'50"W
4: Rock Lake 7-1/2 (Vaughn)
6: limestone
7: pit
9: Permian San Andres Limestone
10: good quality; 12 ft thickness; 200,000 cu. yds.;
Los Angeles Wear cal./ls., 26.4, ls 23.2
Soundness Loss, 3.0; Plasticity index, 4
12: NMSHD (1975, p. 55, #2); MILS (1981)

1: 9N.12E.5.240
2: Pit
3: SE1/4 NE1/4 5 T9N R12E 35o2'9"N 105o40'50"W
4: Clines Corners 7-1/2 (Villanueva)
6: sand and gravel
7: pit
9: Quaternary alluvium
12: MILS (1981); Hunt (1977)

1: 9N.12E.15.140
2: Pit
3: SE1/4 NW1/4 15 T9N R12E 35o00'26"N 105o39'21"W
4: Clines Corners 7-1/2 (Villanueva)
6: sand and gravel
12: MILS (1981)

1: 9N.12E.16.400
2: Pit #5923
3: SE1/4 16 T9N R12E
4: Rock Lake 7-1/2, Clines Corners 7-1/2 (Villanueva)
6: caliche, sand and gravel
7: developed pit
8: produced unknown amount
9: Quaternary pediment deposits
10: good quality; 20 ft thickness; 60,000 cu. yds.;
Los Angeles Wear, 30.0; Plasticity index, 7-N.P.
12: NMSHD (1975, p. 43, #1)

1: 9N.12E.22.100
2: Pit #6120
3: NW1/4 22 T9N R12E 34o59'45"N 105o39'36"W
4: Rock Lake 7-1/2 (Vaughn)
6: sand and gravel
7: developed pit
8: produced unknown amount
9: Quaternary pediment deposits
10: good quality; 9-12 ft thickness; 100,000 cu. yds.; Los Angeles Wear, 30.0; Soundness Loss, 5.0
12: NMSHD (1975, p. 55, #2); MILS (1981)

1: 9N.13E.14.320
2: Pit #5592
3: NE1/4 SW1/4 14 T9N R13E 35o00'17"N 105o31'49"W
4: El Cabo 7-1/2 (Villanueva)
6: limestone
7: developed pit
8: produced unknown amount
9: Permian Yeso Limestone
10: good quality; 15 ft thickness; 325,000 cu. yds.; Los Angeles Wear, 40.0
12: NMSHD (1975, p. 43, #1); MILS (1981); Hunt (1977)

1: 9N.13E.16.300
2: Pit
3: SW1/4 16 T9N R13E 35o00'5"N 105o34'6"W
4: El Cabo 7-1/2 (Villanueva)
6: sand and gravel
12: MILS (1981)

1: 9N.14E.3
2: Pit #5701
3: 3 T9N R14E 35o2'3"N 105o26'54"W
4: Jacinto Mesa 7-1/2 (Villanueva)
6: limestone
7: developed pit
8: produced unknown amount
9: Permian San Andres Limestone
10: good quality; 9 ft thickness; 200,000 cu. yds.; Los Angeles Wear, 28.0; Soundness Loss, 27.2; Plasticity index, 9
12: NMSHD (1975, p. 44, #1); MILS (1981); Hunt (1977)

1: 9N.14E.4
2: Pit
3: 4 T9N R14E 35°2'4"N 105°27'27"W
4: Jacinto Mesa 7-1/2 (Villanueva)
6: sand and gravel (caliche)
12: MILS (1981)

1: 9N.14E.13.400
2: Pit #5596
3: SE1/4 13 T9N R14E 35°00'12"N 105°24'3"W
4: Jacinto Mesa 7-1/2 (Villanueva)
6: sand and gravel
7: developed pit
8: produced unknown amount
9: Quaternary pediment deposits
10: good quality; 14 ft thickness; 400,000 cu. yds.;
Los Angeles Wear, 36.0; Soundness Loss, 18.0
12: NMSHD (1975, p. 44, #1); MILS (1981)

1: 9N.14E.16
2: Pit
3: 16 T9N R14E (approximate)
4: Jacinto Mesa 7-1/2 (Villanueva)
6: sand and gravel
7: pit
9: Quaternary alluvium
12: Hunt (1977)

1: 9N.14E.18.200
2: Pit #813
3: NE1/4 18 T9N R14E
4: Jacinto Mesa 7-1/2 (Villanueva)
6: limestone
7: pit
9: Permian Yeso Formation
10: good quality; 10 ft thickness; 150,000 cu. yds.;
Los Angeles Wear, 38.9; Soundness Loss, 37.8
12: NMSHD (1975, p. 44, #3)

1: 9N.14E.23.200
2: Pit #55128
3: NE1/4 23 T9N R14E
4: Palma 7-1/2 (Vaughn)
6: caliche
7: developed pit
8: produced unknown amount
9: Quaternary pediment deposits
10: excellent quality; 13 ft thickness; 100,000 cu. yds.;
Los Angeles Wear cap., 34.4, soft nod., 39.6;
Soundness Loss, 23.9
12: NMSHD (1975, p. 56, #1)

1: 9N.15E.20.200
2: Pit #5746
3: NE1/4 20 T9N R15E
4: Milagro Spring 7-1/2 (Vaughn)
6: gravel
7: developed pit
9: Quaternary pediment deposits
10: good quality; 31 ft thickness; 17,000 cu. yds.;
Los Angeles Wear, 34.8; Soundness Loss, 3.7
12: NMSHD (1975, p. 56, #1)

1: 9N.15E.21.200
2: Pit #5741
3: NE1/4 21 T9N R15E
4: Milagro Spring 7-1/2 (Vaughn)
6: caliche
7: developed pit
9: Quaternary pediment deposits
10: excellent quality; 8-12 ft thickness; 100,000 cu. yds.;
Los Angeles Wear cap., 36.0, nod. cal., 27.2;
Soundness Loss cap., 14.6, nod. cal., 42.7
12: NMSHD (1975, p. 56, #1)

Table 2-1--Oil and gas tests (including CO_2) drilled in Torrance County, New Mexico. (Abbreviations are defined on p. 181).

Operator, well number, and lease	Location (section-township-range, county)	Completion date (month/year)	Total depth (ft)	Completed status	Producing unit, depth initial potential	Reported shows
Simpson	17-1N-10E Torrance	?/24	940	Abd	----	----
Lubbock #1 H.B. Colbaugh	660' FSL, 660' FWL 12-1N-12E Torrance	8/52	1,137	D&A	----	pe 981
Resler #1 Nalda	660' FSL, 660' FEL 27-1N-15E Torrance	1/46	3,350	D&A	----	pe 3,340
Morris D. Jones #1 Blue Quail Energy-Addison	2310' FNL, 1980' FEL 13-2N-7E Torrance	7/81	4,284	D&A	----	----
Morris D. Jones #1 Blue Quail Energy-Shafner	2310' FNL, 2310' FWL 10-2N-8E Torrance	8/81	5,839	D&A	----	pe 4,250
Morris D. Jones #1 Blue Quail Energy-Shaw	660' FNL, 1980' FEL 6-2N-9E Torrance	8/81	4,355	D&A	----	pe 4,184
Frazier #1 Frazier	200' FSL, 2440' FEL 12-2N-13E Torrance	3/35	1,210	D&A	----	pe 665
Kimmons #1	8-2N-14E Torrance				----	
Abernathy & Jones #1 Dean	1980' FNL, 1980' FWL 28-3N-9E Torrance	8/61	4,117	D&A	----	s/o/g 1,230; s/g 3,165-3,196; s/o 2,015-2,035; 3,060-3,095
Hurley, W. A. #1 Gonce	13-3N-10E Torrance	9/48	800		----	
J.P. Stewart #1 Harry Lamons	650' FNL, 1900' FEL 3-3N-12E Torrance	4/41	767	Temp. abd.	----	s/o 426-428
Morrow Brothers #1 Joe Chavez	18-3N-13E Torrance	8/41	390		----	s/g 134; s/o 241-248
Minerman et al. #2 Permit	23-3N-13E Torrance	9/26	742	D&A	----	
Associated Oil & Gas of NM #1 Luna Fed .	1980' FSL, 1980' FWL 23-3N-13E Torrance	7/53	568		----	s/o 265-278
Pinos Wells #1 Earle	1100' FSL, 4160' FWL 23-3N-13E Torrance	8/26	465	D&A	----	----
Ballard et al. #1 Earle	2990' FNL, 1620' FWL 25-3N-13E Torrance	8/26	73	D&A	----	s/o 66
Hall et al. Pinon Wells	25-3N-13E Torrance	7/28	400	D&A	----	
Ballard #2 Earle	200' FSL, 175' FEL 25-3N-13E Torrance	4/28	350	D&A	----	----
Ballard #1-A Earle	25-3N-13E Torrance	12/27	306'	D&A	----	----

Operator, well number, and lease	Location (section-township-range, county)	Completion date (month/year)	Total depth (ft)	Completed status	Producing unit, depth initial potential	Reported shows
Pinos Wells Oil #1 Anderson	600' FNL, 300' FWL 28-3N-13E Torrance	7/26	252	D&A	——	
Zero Corp, Tex #1 Bonds	660' FSL, 660' FEL 25-3N-14E Torrance	4/78	1,084	D&A	——	pe 1,075
Duran Dome Oil #1 State (Renchan)	1380' FNL, 2251' FEL 31-3N-15E Torrance	4/28	1,630	D&A	——	s/g 640-646; s/o/g 726-803 847-854, 878-894, 932-940, 1,010
Rogers & Binns #1 Alex Hindi	1980' FSL, 1980' FWL 31-3N-15E Torrance	3/53	1,201	Temp abd	——	s/o 604; 616; 630
Corona-Tularosa #1 Tularosa	35-3N-15E Torrance	?/24	1,400	D&A	——	
Albert C. Lang #1 Whitlow	1650' FNL, 2310' FEL 31-3N-15E Torrance	1/56	1,176		——	pe 1,163
Navajo Oil Bussel-McFarr	2-4N-6E Torrance				——	
M.A. Romero #2 Sam Shaw	447' FSL, 535' FEL 13-4N-7E Torrance	9/80	2,841	Suspended drilling	——	pe @ TD
Mountainair Oil & Gas #1 Veal	1980' FSL, 660' FWL 32-4N-7E Torrance	?/50	3,104	P&A	——	s/o 2,190-2,240; 2,490-2,502 2,600-2,615; 2,853-2,866; s/g 2,426-2,900
M.A. Romero #1 Sam Shaw	919' FSL, 571' FWL 18-4N-8E Torrance	3/79	2,008	D&A	——	
RAF Enterprises #1 Shaw	919' FSL, 371' FWL 18-4N-8E Torrance	10/80	175	Suspended drilling	——	——
Eidal Manuf. Co. #1 Mitchell	846' FNL, 2250' FEL 33-4N-8E Torrance	3/47	3,592	D&A	——	s/g 3,460-3,465 [CO_2] pe 3,518
Bluehall Oil #1 Kistler	585' FNL, 638' FWL 7-4N-10E Torrance	10/29	1,780	D&A	——	s/o 170-181, 208-209, 728-745, 805-810, 923-935 s/CO_2
Williams, Jack #1 Harry Limonds	3-4N-12E Torrance				——	
Williams, Jack #1 Ashcraft	22-4N-12E Torrance	2/35	450	D&A	——	
T.A. Rogers & R.W. Poyner #2 Rogers-Fed	660' FSL, 1980' FWL 26-4N-12E Torrance	11/52	665	D&A	——	s/g 150-155; 320-322 s/o 335; 660 pe 275 (?)
R.W. Poyner & T.A. Rogers #1 Federal	660' FSL, 660' FEL 34-4N-12E Torrance	3/52	643	D&A	——	
Navajo Oil #1 Manzano	36-5N-6E Torrance	12/37	2,147	D&A	——	s/o 1,112, 1,137, 1,218, 1,455
W.L. Cacy #1-A Cacy	2151' FNL, 660' FEL 23-6N-5E Torrance	8/58	955	Temp. abd.	——	s/o 530-570;785, 701-709; s/g 720-725; s/o/g 888-890

Operator, well number, and lease	Location (section-township-range, county)	Completion date (month/year)	Total depth (ft)	Completed status	Producing unit, depth initial potential	Reported shows
Overmier & Cacy #1 Cacy	1980' FNL, 660' FEL 23-6N-5E Torrance	5/55	575	D&A	——	s/g 450-525 pe 508(?)
Sweetman, Parnell, Aday #1 Cecil de Spain	1980' FNL, 1980' FWL 12-6N-6E Torrance	11/54	1,343	D&A	——	s/g 1,006-1,022; 1,047-1,106; 1,263, 1,288 s/o/g 1,303 pe 1,260
Estancia Co. #1 Munoz	990' FSL, 1320' FWL 5-6N-7E Torrance	1/26	1,346	D&A	——	s/o/g 528-605 [CO_2] s/CO_2 1,027-1,032 s/o 1,027-1,032 pe 1,346
F.D. Meyers #1 Milbourne	660' FNL, 1980' FWL 12-6N-7E Torrance	11/63	1,844	D&A		SI, [CO_2] well
Chief Oil & Gas #1-A Pace	1980' FSL, 660' FWL 12-6N-7E Torrance	6/28	2,020		[CO_2] 1,645-1760 Penn. 50,000 ft^3/day	s/o 1,390-1,400 s/CO_2 1,645-1,760 99% CO_2 Recompleted in 1939 to 60 MCFPD
ChiefOil & Gas #1 Pace	1420' FSL, 2310' FEL 12-6N-7E Torrance	7/38	2,062		[CO_2], 1,597 Penn 1,000,000 ft^3/day	s/g 1,591-1,597 1,000 MCFPD 100% CO_2 pe 2,045
F.D. Meyers #1 Smith & Pace	1700' FSL, 550' FWL 12-6N-7E Torrance	11/63	1,910	D&A	Pennsylvanian SI, CO_2 well 50,000 ft^3/day	[CO_2] 50 MCFPD Initial Production Figure
Witt Ice Co. #1 Meadows	1640' FNL, 660' FWL 23-6N-7E Torrance	6/44	2,123	D&A		pe 1,900
Walter J. Nelson #1 Lee Burns "A"	660' FSL, 660' FEL 31-6N-8E Torrance	9/68	2,858	temp. abd.		
F.B. Gilbreath #1 Berkshire	660' FNL, 1980' FWL 19-6N-9E Torrance	1/51	2,640	D&A		pe 1,735 (?)
Murphree & Bond #1 Berkshire Bros.	330' FNL, 990' FWL 19-6N-9E Torrance	3/48	3,273	D&A		DST'S (5) 3 showed oil or oil and gas cut mud. s/o 1,370; 2,520-2,560 pe 3,120
Houston Oil & Minerals #1 Berkshire Ranch	1980' FSL, 1980' FWL 29-6N-9E Torrance	10/76	2,671	D&A		
San Juan Coal & Oil #1 Randall	20-6N-10E Torrance	?/26	320	D&A		
San Juan Coal & Oil #2 Randall	550' FNL, 1050' FWL 20-6N-10E Torrance	3/28	5,321	D&A		s/o 3,297-3,310; 3,485-3,500; 4,600-4,725
Gardner Pet. Corp. #1 Ed Kidwell	660' FSL, 2080' FWL 21-6N-10E Torrance	5/54	5,918	D&A		s/o 3,415-3,430; 5,340; 5,467-5,487; 5,480 pe 5,675
Houston Oil & Minerals #14 Fed-28	660' FSL, 660' FWL 28-6N-10E Torrance	11/76	8,756	D&A		pe @ 5,530 (LOGS)
Superior Oil Co. #28-31 Blackwell	330' FSL, 990' FWL 31-6N-11E Torrance	1/54	2,646	D&A		pe 2,590
Petrol Oil Co. #1 State	660' FSL, 1980' FEL 1-6N-13E Torrance	7/45	940	D&A		Gas flowing @ 890 pe 455

Operator, well number, and lease	Location (section-township-range, county)	Completion date (month/year)	Total depth (ft)	Completed status	Producing unit, depth initial potential	Reported shows
C.U. Norton #1-X Perez	680' FNL, 660' FWL 18-6N-14E Torrance	11/70	720	D&A	----	s/o 700 pe 700
Estancia Valley CO_2 Dev. Co. #2 Kellogg	250' FSL, 1950' FEL 1-7N-7E Torrance	6/36	1,415	D&A		pe 1,342
Sinoco Oil #1 DeHart	12-7N-7E Torrance	8/28	765	D&A		s/o 485; s/g 214; 232 CO_2
Estancia Valley CO_2 #2 Gerhart	12-7N-7E Torrance	1/35	1,270	----	[CO_2] 700,000 MCFPD Pennsylvanian 1,265-1,270 CO_2 98%	----
Sinoco Oil #2 DeHart	1100' FSL, 2310' FWL 12-7N-7E Torrance	6/31	1,440		Penn. limestone [CO_2], 1,240	s/g 1,240-1,251 [CO_2] 140 MCFPD 97% CO_2 660 MCFPD initial production 225 MCFPD pe @ 1,280
Estancia Valley CO_2 Dev. Co. #2 DeHart	2560' FNL, 2335' FEL 12-7N-7E Torrance	9/34	1,274	P&A	Pennsylvanian [CO_2], 1,208-15 648,000 ft^3/day	s/g 263-268; s/g 1,208-1,215 CO_2 Initial production 648 MCFPD 99% CO_2 pe 1,271
Estancia Valley CO_2 Dev. Co., #3 DeHart	1644' FNL, 2187' FEL 12-7N-7E Torrance	10/36	1,264		Pennsylvanian 1,204-1,264 [CO_2] I.P. 710,000 ft^3/day	[CO_2] 710 MCFPD
Estancia Valley CO_2 Dev. Co., #4 DeHart	2310' FSL, 2612' FEL 12-7N-7E Torrance	8/36	1,236		Pennsylvanian <1,236 [CO_2] 100,000 ft^3/day	[CO_2] 100 MCFPD
Estancia Valley CO_2 Dev. Co. #5 DeHart	1931' FNL, 1646' FEL 12-7N-7E Torrance	6/37	1,258		Pennsylvanian 1,233-1,258 [CO_2] 250,000 ft^3/day	[CO_2] 250 MCFPD
Estancia Valley CO_2 Dev. Co. #1 Kellogg	1000' FNL, 1892' FEL 12-7N-7E Torrance	10/35	1,268		Pennsylvanian 1,264-1,268 [CO_2], 860,000 ft^3/day	[CO_2] 860 MCFPD CO_2 100%
Estancia Valley CO_2 Dev. Co. #1 Roland	600' FSL, 600' FEL 12-7N-7E Torrance	5/34	1,359	P&A	Pennsylvanian 1,214-1,271	[CO_2] s/g 1,214; 1,271
Estancia Valley CO_2 Dev. Co., #2 Stubbs	12-7N-7E Torrance					[CO_2]
Estancia Valley CO_2 #4 Wilcox Dome	12-7N-7E Torrance	?/35	>1,050			[CO_2]
Witt Oil & Gas #3 Hart or Kellogg	12-7N-7E Torrance	?/33				
Sinoco, et al #1 Kutchin	660' FNL, 1980' FWL 13-7N-7E Torrance	12/29	302	D&A		
Estancia Valley CO_2 Dev. Co., #1 Kutchin	355' FNL, 1347' FWL 13-7N-7E Torrance	2/37	1,428		Pennsylvanian <1,428 [CO_2] 150,000 ft^3/day	CO_2 150 MCFPD
Estancia Valley Dev. Co. #1 Crawford	990' FNL, 330' FEL 32-7N-7E Torrance	7/39	1,355	P&A		s/g 450; 634 [CO_2]

Operator, well number, and lease	Location (section-township-range, county)	Completion date (month/year)	Total depth (ft)	Completed status	Producing unit, depth initial potential	Reported shows
Drice Co. #1 Garland	1650' FNL, 330' FEL 32-7N-7E Torrance	10/40	2,200	P&A	Precambrian schist 1,965	s/g 1,965 [CO_2] odors pe 1,280
Orville J. Lee #1 Milburn	660' FSL, 660' FWL 36-7N-7E Torrance	12/41	2,000		Precambrian schist 1,770-1,813 [CO_2] 50,000 ft^3/day	asphalt 368; 50 MCFPD; s/CO_2 1,722, 1,769, 1,792, 1,803, 1,807, 1,813; pe 1,550 12 MMCFPD est. from deepened well
R. Olsen Oil Co. #1 Means	660' FNL, 660' FWL 27-7N-9E Torrance	6/50	3,680	D&A		pe 3,160
San Juan Coal & Oil #1 Minerman	1980' FSL, 660' FEL 32-7N-10E Torrance	10/26	2,647	D&A		s/o 250-260; 460-548; 1,027; 1,510-1,517; 1,655-1,805; 2,571-2,598
Pollard Bros. H.J. Sewell	1980' FNL, 660' FEL 28-8N-8E Torrance	8/57	446	temp. abd.		
Woodson Expl. Co. #1 Meads	230' FSL, 1850' FEL 30-8N-8E Torrance	9/56	645	temp. abd.		
H.L. Williams #1 Staplin	220' FNL, 220' FEL 16-8N-10E Torrance		1,650	D&A		s/g 730 s/o 1,140-1,148
Hatch Petro. #1 Hatch Petroleum	26-8N-11E Torrance	?/26		D&A		
Toltec Oil #1 State	8-8N-13E Torrance	?/24	670	D&A		
Toltec Oil #1 State lease	8-8N-13E Torrance	?/18	1,110	D&A		
Cardinal Oil #1 State	765' FSL, 1720' FWL 3-8N-14E Torrance	8/49	2,368	D&A		s/g 1,130 s/o 1,650
Toltec Oil #2 State	8-8N-14E Torrance	?/24	528	D&A		
F.B. Umbarger #1 State	80' FNL, 2,540' FWL 10-8N-14E Torrance	3/50	2,775	D&A		pe 2,775
Brock, et al. #1 McLean	8-8N-15E Torrance	10/25	500	D&A		
The 48 Pet. #1 Greenfield	1980' FSL, 660' FWL 17-9N-8E Torrance	11/36	2,160	D&A		s/CO_2 530 pC- 1,930

Operator, well number, and lease	Location (section-township-range, county)	Completion date (month/year)	Total depth (ft)	Completed status	Producing unit, depth initial potential	Reported shows
Witt Ice & Gas Co. #1 Cornett	2040' FSL, 2040' FWL 32-9N-8E Torrance	4/44	2,402	P&A		pe 790

Definitions of abbreviations:

FEL - from east line
FNL - from north line
FSL - from south line
FWL - from west line
D&A - dry and abandoned
P&A - plugged and abandoned
SI - shut in
IP - initial production
s/CO_2 - show of CO_2
s/g - show of gas
s/o - show of oil
MCFPD - thousand cubic feet per day
TD - total depth
temp. abd. - temporarily abandoned

Table 2-2 – Petroleum tests that bottomed in Precambrian rocks in Torrance County, New Mexico.

Well name & number	Location	Elevation (ft)	Top of Precambrian (ft)	Precambrian elevation (ft)	Comments
Lubbock H.B. Colbaugh	660 FSL & FWL 12.1N.12E	6,450 (GL) (EST)	981	(±)+5,469	Cuttings Foster and Stipp, (1961)
Resler Dale #1 Nalda	660 FSL & FEL 27.1N.15E	6,396 (GL)	3,340	+3,056	Cuttings Foster and Stipp, (1961)
Jones #1 Blue Quail-Addison	2,310 FNL 1,980 FEL 13.2N.7E	6,680 (GL)	454 (EST)	(±)+2,151	Top from logs and scout reports (NMBM&MR files)
Jones #1 Blue Quail Shafner	2,310 FNL & FWL 10.2N.8E	6,554 (KB)	4,250	+2,304	Top from logs and scout reports (NMBM&MR files)
Jones #1 Blue Quail Shaw	660 FNL & 1,980 FEL 6.2N.9E	6,625 (KB)	4,184	+2,441	Tops from logs and scout reports (NMBM&MR files)
Frazier #1 Frazier	220 FSL & 2,440 FEL 12.2N.13E	6,432 (GL) (EST)	665	(±)+5,767	Foster and Stipp (1961)
Keoughman #1 Jack Dean	1,980 FNL & FWL 28.3N.9E	6,520 (GL)	3,994	+2,801	Top from logs and scout reports (NMBM&MR files)
Stewart #1 Lemmons	650 FNL 1,900 FEL 3.3N.12E	6,400 (GL) (EST)	190	(±)+6,210	Foster and Stipp (1961)
Associated #1 Luna-Fed	1,980 FSL & FWL 25.3N.13E	6,130 (GL) (EST)	477	(±)+5,653	Foster and Stipp (1961)
Zero Corp. Tex #1 Bonds	660 FSL & FEL 25.3N.14E	6,368 (GL)	1,075	+5,293	Top from samples and scout reports (NMBM&MR files)
Albert C. Lang #1 Whitlow	1,650 FNL & 2,310 FEL 31.3N.15E	6,200 (GL) (EST)	1,163	(±)+5,037	Foster and Stipp (1961)
Duran Dome #1 State Renehan	1,380 FNL & 2,251 FEL 31.3N.15E	6,300 (GL) (EST)	1,215	(±)+5,085	Topographic maps Foster and Stipp (1961)
M.A. Romero #2 Sam Shaw	447 FSL & 535 FEL 13.4N.7E	6,310 (GL)	4,080	(±)+2,230	Estimated from logs and offset wells (NMBM&MR files)
Mountainair #1 Veal	1,980 FSL & 660 FWL 32.4N.7E	6,450 (GL)	3,190 (EST)	(±)+3,350	Estimated from samples log and offset E-logs (NMBM&MR files)
Eidal Mfg. #1 Mitchell	846 FNL & 2,250 FEL 33.4N.8E	6,350 (GL)	3,518	+2,832	Topographic maps Foster and Stipp (1961)
Rogers & Poyner #2 Federal	660 FSL & 1,980 FWL 26.4N.12E	6,100 (GL) (EST)	surface	(±)+6,100	Scout reports (NMBM&MR files)
Rogers & Poyner #1 Federal	660 FSL & FEL 34.4N.12E	6,350 (GL)	surface	+6,350	Foster and Stipp (1961)
Navajo Oil #1 Manzano	36.5N.6E	6,465 (GL)	2,457 (EST)	(±)+4,008	Sample and drillers log; top estimated from local stratigraphy (NMBM&MR files)
Overmier & Cacy #1 Cacy	1,980 FNL & 660 FEL 23.6N.5E	7,505 (GL) (EST)	508	(±)+6,977	Top estimated from local stratigraphy
Sweetman, Parnell and Aday #1 Cecil Despain	1,980 FNL & FWL 12.6N.6E	7,029 (DF)	1,260	+5,769	Foster and Stipp (1961)
Estancia Oil #1 Munoz	990 FSL & 1,980 FWL 5.6N.7E	6,800 (GL)	1,320	+5,480	Foster and Stipp (1961)

APPENDIX 3

STATISTICAL SUMMARIES OF NURE HSSR GEOCHEMICAL DATA

Table 3-1--Statistical summary for uranium content of Estancia Valley water samples (Olsen, 1977).

Table 3-2--Statistical summary for uranium content of Estancia Valley stream sediments (Olsen, 1977).

Table 3-3--Statistical summary of stream sediments from the Albuquerque 1- by 2-degree quadrangle.

Table 3-4--Statistical summary of stream sediments from the Santa Fe 1- by 2-degree quadrangle.

Table 3-5--Statistical summary of stream sediments from the Socorro 1- by 2-degree quadrangle.

Table 3-6--Statistical summary of stream sediments from the Ft. Sumner 1- by 2-degree quadrangle.

Table 3-7--Statistical summary of stream sediments from the four 1- by 2-degree quadrangles listed immediately above.

Table 3-8--Statistical summary of uranium in water samples from the Albuquerque, Santa Fe, Socorro, and Ft. Sumner quadrangles.

Table 3-9--Statistical summary of stream sediments and water samples from the Scholle area (Pierson and others, 1982).

Table 3-10--Statistical summary of stream sediments from the Manzano Wilderness study (Maxwell and Wobus, 1983b).

Key to Tables 3-1 through 3-10:

VAR - Variable

NADL - Number of samples above detection limit

NBDL - Number of samples below detection limit

MISS - Number of samples missing

STD. DEV. - Standard deviation

TU - Thorium/uranium ratio

MIN - Minimum

MAX - Maximum

Table 3-1--Statistical summary for uranium content of Estancia Valley water samples by delayed neutron counting or fluorometry (Olsen, 1977).

Type of water source	Number of sample points	Mean (ppb)	Standard deviation (ppb)	Uranium concentration (ppb) Max.	Min.
Streams	161	3.03	3.65	30.00	0.10
Springs	11	3.19	2.46	8.60	0.20
Wells	197	5.23	5.73	37.00	0.17
Natural ponds	20	4.54	7.42	33.00	0.16
Artificial ponds	135	1.78	1.91	12.70	0.10
Playas	10	66.53	116.50	334.00	0.50
TOTAL	534				

Table 3-2—Statistical summary for uranium content of Estancia Valley stream sediments by delayed neutron counting (Olson, 1977).

Sample type	Number of sample points	Mean (ppm)	Standard deviation (ppm)	Uranium concentration (ppm) Max.	Min.
Wet streams	512	3.00	0.60	6.70	0.90
Wet springs	8	2.86	0.80	3.90	1.80
Wet ponds	175	3.05	0.83	9.90	1.90
Dry streams	1,861	2.93	0.86	10.70	0.70
Dry ponds	380	2.78	0.71	8.90	1.50
All valley sediments	2,936	2.92	0.73	10.70	0.70

VAR		TOTAL	NAOL	NBDL	MISS	FOR TOTAL ANALYSES: MEAN	STD.DEV.	SKEWNESS	KURTOSIS	FOR ABOVE DETECTION LIMIT ANALYSES: MEAN	STD.DEV.	SKEWNESS	KURTOSIS	MAXIMUM	MIN(ADL)	DETECT. LIMIT MEAN	STDEV
1	PH	146	146	0	1392	7.51	.60	-3.58	26.82	7.51	.60	-3.58	26.82	9.30	3.20	0.00	0.00
2	CT	147	147	0	1391	847.53	1965.76	4.21	21.32	847.53	1965.76	4.21	21.32	13000.00	43.00	0.00	0.00
3	U	1538	1538	0	0	3.53	1.84	5.81	58.26	3.53	1.84	5.81	58.26	28.52	.63	0.00	0.00
4	AG	1538	22	1516	0	2.59	1.25	25.43	758.09	8.73	8.44	3.23	12.77	43.00	5.00	5.00	0.00
5	BI	1538	146	1392	0	2.83	1.12	4.60	35.26	5.96	1.58	3.86	25.94	18.00	5.00	5.00	0.00
6	CD	1538	25	1513	0	2.56	.55	11.32	166.54	6.40	1.94	2.34	9.65	14.00	5.00	5.00	0.00
7	CU	1538	1474	64	0	22.65	20.55	16.47	383.96	23.42	20.66	16.85	390.21	575.00	10.00	10.00	0.00
8	NB	1538	31	1507	0	10.47	3.80	10.98	152.88	33.26	13.63	2.10	7.13	81.00	20.00	20.00	0.00
9	NI	1538	343	1195	0	11.23	20.05	31.65	1147.71	24.21	39.82	17.11	307.86	742.00	15.00	15.00	0.00
10	PB	1538	1281	257	0	12.73	12.44	6.87	82.79	14.79	12.67	7.42	87.27	201.00	5.00	5.00	0.00
11	SN	1538	39	1499	0	5.23	1.76	12.33	207.28	13.97	6.60	2.91	12.26	44.00	10.00	10.00	0.00
12	W	1538	49	1489	0	7.93	2.71	8.04	80.92	21.06	7.20	1.87	6.06	45.00	15.00	15.00	0.00
13	AS		0	0	1538	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	SE		0	0	1538	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	ZR		0	0	1538	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	MO		0	0	1538	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	BE	1538	1428	110	0	1.86	1.11	3.06	18.77	1.96	1.09	3.40	20.69	11.00	1.00	1.00	0.00
18	LI	1538	1538	0	0	36.44	16.88	1.52	8.67	36.44	16.88	1.52	8.67	184.00	3.00	0.00	0.00
19	AL	1538	1538	0	0	51147.86	11496.63	.27	3.25	51147.86	11496.63	.27	3.25	101200.00	16030.00	0.00	0.00
20	AU	1538	6	1532	0	.03	.02	14.46	325.56	.24	.15	.84	2.36	.51	.07	.06	.02
21	BA	1538	1518	20	0	599.15	264.48	4.09	36.49	605.76	259.82	4.38	39.06	3598.00	162.00	195.30	40.05
22	CA	1538	1527	11	0	17112.10	15974.54	5.48	62.73	17230.82	15970.38	5.51	63.07	262400.00	2034.00	1262.82	587.14
23	CE	1538	1538	0	0	67.14	31.50	4.25	38.44	67.14	31.50	4.25	38.44	457.00	12.00	0.00	0.00
24	CL	1538	178	1360	0	68.66	199.67	16.86	388.59	328.14	517.54	6.74	59.30	5409.00	30.00	69.40	16.03
25	CO	1538	1537	1	0	7.11	2.33	1.84	11.81	7.11	2.33	1.86	11.86	27.00	2.40	2.60	.00
26	CR	1535	1514	21	3	34.36	14.00	2.05	13.87	34.76	13.68	2.26	14.89	157.00	10.00	11.43	3.20
27	CS	1538	1466	72	0	3.15	2.18	7.80	113.27	3.28	2.16	8.34	121.54	43.70	.80	1.31	.49
28	DY	1538	1538	0	0	4.11	1.79	3.23	22.58	4.11	1.79	3.23	22.58	23.00	1.00	0.00	0.00
29	EU	1538	1532	6	0	.95	.29	1.96	14.90	.95	.28	2.10	15.45	3.70	.20	.28	.07
30	FE	1538	1538	0	0	15588.84	10415.61	5.36	51.69	15588.84	10415.61	5.36	51.69	160900.00	3625.00	0.00	0.00
31	HF	1538	1538	0	0	13.51	9.06	3.71	30.82	13.51	9.06	3.71	30.82	122.80	2.60	0.00	0.00
32	K	1538	1538	0	0	16270.89	3294.41	.77	4.77	16270.89	3294.41	.77	4.77	31590.00	7017.00	0.00	0.00
33	LA	1536	1531	5	2	36.00	16.50	4.23	39.33	36.10	16.43	4.30	39.99	249.00	7.00	9.40	1.02
34	LU	1538	1533	5	0	.48	.24	5.26	68.27	.48	.24	5.30	68.97	4.70	.10	.22	.10
35	MG	1538	1422	116	0	9680.21	4739.44	1.26	8.81	10299.98	4380.17	1.73	11.21	53500.00	2986.00	4165.60	888.93
36	MN	1538	1538	0	0	411.64	233.00	2.29	14.07	411.64	233.00	2.29	14.07	2678.00	61.00	0.00	0.00
37	NA	1538	1538	0	0	9655.34	4009.92	1.12	5.18	9655.34	4009.92	1.12	5.18	30140.00	1703.00	0.00	0.00
38	RB	1538	1293	245	0	40.55	18.23	.48	4.70	45.99	14.32	1.63	7.87	137.00	20.00	23.65	9.60
39	SB	1536	28	1508	2	1.00	.45	4.36	66.56	2.29	1.46	3.42	16.14	9.00	1.00	1.95	.75
40	SC	1538	1538	0	0	5.93	2.44	3.72	32.42	5.93	2.44	3.72	32.42	34.10	1.60	0.00	0.00
41	SM	1538	1535	3	0	4.65	2.27	3.28	23.78	4.66	2.27	3.31	23.95	29.50	.80	1.43	.09
42	SR	1538	106	1432	0	148.40	92.16	5.51	54.62	407.25	186.92	2.83	15.90	1563.00	160.00	258.48	69.54
43	TA	1370	306	1064	168	.81	.79	3.92	25.37	1.84	1.16	2.12	10.89	10.00	1.00	1.03	.24
44	TB	1470	142	1328	68	.57	.24	5.86	53.40	1.15	.43	3.40	17.24	4.00	1.00	1.00	.08
45	TH	1538	1538	0	0	10.92	5.30	4.32	39.76	10.92	5.30	4.32	39.76	83.50	2.10	0.00	0.00
46	TI	1534	1534	0	4	3792.08	1552.92	2.18	11.70	3792.08	1552.92	2.18	11.70	16000.00	1143.00	0.00	0.00
47	V	1538	1532	6	0	59.82	32.77	3.03	17.93	60.03	32.66	3.08	18.14	327.00	14.00	11.00	3.37
48	YB	1538	1486	52	0	3.83	1.86	4.15	47.07	3.93	1.81	4.61	52.63	32.60	1.10	2.06	.81
49	ZN	1516	1001	515	22	52.68	37.02	3.42	36.47	69.52	34.65	5.26	59.75	557.00	12.00	39.91	17.83
50	TU	1538	1538	0	0	3.15	.64	.02	6.73	3.15	.64	.02	6.73	7.04	.25	0.00	0.00

NUMBER OF SAMPLES = 1538

Table 3-3 -- Statistical summary of stream sediments from the Albuquerque 1- by 2-degree quadrangle. (Michael E. Madson, Bendix Field Engineering, Corp., 1983).

SANTA F

VAR	TOTAL	NADL	NBDL	MISS	FOR TOTAL ANALYSES: MEAN	STD.DEV.	SKEWNESS	KURTOSIS	FOR ABOVE DETECTION LIMIT ANALYSES: MEAN	STD.DEV.	SKEWNESS	KURTOSIS	MAXIMUM	MIN(ADL)	DETECT. LIMIT MEAN	DETECT. LIMIT STDEV
1 PP	174	174	0	958	7.44	.87	.32	8.56	7.44	.87	.32	8.56	11.60	3.80	0.00	0.00
2 CT	175	175	0	957	480.41	516.94	2.97	14.81	480.41	516.94	2.97	14.81	3400.00	29.00	0.00	0.00
3 U	1132	1132	0	0	3.94	3.39	13.82	291.73	3.94	3.39	13.82	291.73	84.38	.88	0.00	0.00
4 AG	1127	8	1119	5	2.53	.40	17.17	346.45	6.63	2.29	1.47	3.95	12.00	5.00	5.00	0.00
5 BI	1127	151	976	5	2.97	1.32	4.01	31.58	5.98	1.58	4.92	41.83	20.00	5.00	5.00	0.00
6 CD	1127	24	1103	5	2.57	.56	10.34	136.29	5.92	1.82	2.43	7.78	12.00	5.00	5.00	0.00
7 CU	1127	1081	46	5	21.83	17.59	15.84	327.96	22.55	17.60	16.38	337.91	419.00	10.00	10.00	0.00
8 MB	1127	18	1109	5	10.30	2.63	10.60	134.85	28.89	8.99	1.51	5.04	56.00	20.00	20.00	0.00
9 NI	1127	557	570	5	14.74	10.03	5.78	94.56	22.16	9.75	10.45	178.92	195.00	15.00	15.00	0.00
10 PB	1127	990	137	5	19.27	56.05	12.00	191.12	21.59	59.43	11.35	170.34	1103.00	5.00	5.00	0.00
11 SN	1127	5	1122	5	5.14	2.96	76.56	769.43	36.80	31.17	1.05	2.65	95.00	10.00	10.00	0.00
12 W	1127	36	1091	5	7.84	1.98	6.48	49.93	18.17	3.52	1.98	6.92	31.00	15.00	15.00	0.00
13 AS	0	0	0	1132	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14 SE	0	0	0	1132	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15 ZR	0	0	0	1132	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16 MO	0	0	0	1132	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17 BE	1129	1083	46	3	1.77	.57	-.31	3.32	1.82	.52	-.13	3.56	4.00	1.00	1.00	0.00
18 LI	1129	1129	0	3	28.49	10.28	1.79	9.62	28.49	10.28	1.79	9.62	102.00	2.00	0.00	0.00
19 AL	1132	1132	0	0	48548.22	9460.01	.38	3.87	48548.22	9460.01	.38	3.87	88810.00	14870.00	0.00	0.00
20 AU	1132	4	1128	0	.04	.01	3.58	35.65	.13	.04	-.91	2.12	.16	.06	.07	.02
21 BA	1132	1120	12	0	479.47	152.92	4.48	58.32	483.44	148.71	5.02	64.92	2827.00	196.00	217.92	116.58
22 CA	1132	1131	1	0	22919.02	21937.87	3.44	18.93	22937.06	21939.17	3.44	18.93	196400.00	2376.00	4830.00	0.00
23 CE	1132	1132	0	0	66.79	32.84	7.67	100.31	66.79	32.84	7.67	100.31	619.00	11.00	0.00	0.00
24 CL	1132	105	1027	0	53.30	108.90	15.39	307.78	224.96	307.57	5.52	37.86	2558.00	47.00	71.49	17.77
25 CO	1132	1132	0	0	7.68	3.14	2.72	18.55	7.68	3.14	2.72	18.55	36.10	.90	0.00	0.00
26 CR	1132	1129	3	0	48.36	18.80	10.45	217.72	48.46	18.71	10.64	222.22	465.00	12.00	16.33	3.40
27 CS	1132	1109	23	0	3.97	2.47	6.14	71.75	4.03	2.45	6.35	74.44	42.70	.90	1.75	.73
28 DY	1132	1132	0	0	5.48	3.06	5.69	54.55	5.48	3.06	5.69	54.55	47.00	1.00	0.00	0.00
29 EU	1132	1131	1	0	1.35	.41	3.30	24.30	1.35	.41	3.34	24.54	5.50	.60	.40	0.00
30 FE	1132	1132	0	0	23656.65	10568.50	4.83	48.85	23656.65	10568.50	4.83	48.85	164300.00	4847.00	0.00	0.00
31 HF	1132	1132	0	0	14.76	8.23	3.07	18.22	14.76	8.23	3.07	18.22	95.50	3.80	0.00	0.00
32 K	1132	1128	4	0	15647.81	4037.58	.33	3.43	15686.45	3989.45	.39	3.34	32460.00	4551.00	9506.00	******
33 LA	1132	1131	1	0	34.55	17.19	7.08	85.47	34.58	17.18	7.10	85.79	307.00	9.00	10.00	0.00
34 LU	1132	1132	0	0	.54	.30	4.80	39.83	.54	.30	4.80	39.83	4.10	.10	0.00	0.00
35 MG	1132	1116	16	0	5827.06	2503.32	2.99	24.29	5892.09	2459.43	3.22	25.92	32975.00	1495.00	2581.13	******
36 MN	1132	1132	0	0	470.35	300.61	10.41	179.22	470.35	300.61	10.41	179.22	6394.00	93.00	0.00	0.00
37 NA	1132	1132	0	0	9172.50	3558.28	1.35	5.42	9172.50	3558.28	1.35	5.42	25980.00	1399.00	0.00	0.00
38 RB	1132	938	194	0	53.63	23.66	-.18	2.52	61.69	17.08	.47	2.86	117.00	24.00	29.30	9.41
39 SB	1132	19	1113	0	.92	.43	5.08	52.56	2.95	1.47	.99	2.64	6.00	1.00	1.76	.57
40 SC	1132	1132	0	0	7.56	2.77	2.15	11.29	7.56	2.77	2.15	11.29	27.90	1.60	0.00	0.00
41 SM	1132	1131	1	0	5.87	3.24	6.00	57.31	5.87	3.23	6.01	57.43	45.60	1.30	2.60	.00
42 SR	1131	44	1087	1	134.02	76.90	7.74	93.54	411.14	222.41	2.46	10.22	1389.00	194.00	245.60	60.54
43 TA	1130	170	960	2	.80	.78	3.51	19.12	2.34	1.09	1.58	8.34	8.00	1.00	1.05	.27
44 TB	1126	134	992	6	.63	.48	6.06	54.05	1.57	.94	2.62	12.26	7.00	1.00	1.01	.11
45 TH	1132	1132	0	0	11.34	6.16	8.25	106.56	11.34	6.16	8.25	106.56	113.00	2.40	0.00	0.00
46 TI	1131	1131	0	1	4090.91	1316.79	4.09	38.04	4090.91	1316.79	4.09	38.04	21460.00	750.00	0.00	0.00
47 V	1132	1131	1	0	61.79	21.02	3.03	21.71	61.83	20.99	3.05	21.83	258.00	9.00	33.00	0.00
48 YB	1132	1118	14	0	4.24	2.40	5.33	50.52	4.28	2.38	5.48	51.93	36.30	1.30	1.90	.56
49 ZN	1109	670	439	23	59.03	87.75	20.22	543.90	83.32	105.67	18.50	410.81	2497.00	18.00	43.91	23.35
50 TU	1132	1132	0	0	3.07	.66	-.47	4.92	3.07	.66	-.47	4.92	5.53	.25	0.00	0.00

NUMBER OF SAMPLES = 1132

Table 3-4 -- Statistical summary of stream sediments from the Santa Fe 1- by 2-degree quadrangle. (Michael E. Madson, Bendix, Field Engineering, Corp., 1983).

VAR		TOTAL	NADL	NBDL	MISS	FOR TOTAL ANALYSES: MEAN	STD.DEV.	SKEWNESS	KURTOSIS	FOR ABOVE DETECTION LIMIT ANALYSES: MEAN	STD.DEV.	SKEWNESS	KURTOSIS	MAXIMUM	MIN(ADL)	DETECT. LIMIT MEAN	DETECT. LIMIT STDEV
1	U	1324	1324	0	0	3.14	12.19	36.00	1305.05	3.14	12.19	36.00	1305.05	445.10	.84	0.00	0.00
2	AG	1324	27	1297	0	2.60	.76	9.39	106.89	7.33	2.33	1.50	5.37	15.00	5.00	5.00	0.00
3	CU	1324	1292	32	0	23.17	9.71	3.32	39.76	23.62	9.39	3.80	45.44	163.00	10.00	10.00	0.00
4	MB	1324	22	1302	0	10.40	3.92	10.57	129.92	34.27	12.98	1.01	3.36	69.00	20.00	20.00	0.00
5	NI	1324	502	822	0	14.35	11.47	3.00	18.36	25.57	12.50	3.29	19.34	126.00	15.00	15.00	0.00
6	PB	1324	1007	317	0	10.17	16.67	15.19	313.06	12.58	18.47	14.26	265.72	410.00	5.00	5.00	0.00
7	SN	1324	20	1304	0	5.13	1.14	10.37	125.78	13.55	3.65	1.44	4.26	24.00	10.00	10.00	0.00
8	ZR		C	0	C	1324	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	MO		0	0	0	1324	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	BE	1323	1307	16	1	2.33	.73	3.41	52.94	2.35	.71	3.93	60.30	14.00	1.00	1.00	0.00
11	LI	1323	1323	0	1	31.11	14.89	2.92	20.11	31.11	14.89	2.92	20.11	171.00	2.00	0.00	0.00
12	AL	1324	1324	0	0	54240.95	13505.66	.14	2.80	54240.95	13505.66	.14	2.80	107900.00	14200.00	0.00	0.00
13	BA	1324	1320	4	0	619.60	269.74	4.66	39.86	620.69	268.39	4.76	40.61	3761.00	162.00	120.25	24.87
14	CA	1324	1324	0	0	27449.79	21770.69	3.35	23.15	27449.79	21770.68	3.35	23.15	247300.00	2165.00	0.00	0.00
15	CE	1323	1322	1	1	58.91	18.99	.50	5.01	58.95	18.93	.52	5.01	176.00	12.00	5.00	0.00
16	CO	1323	1322	1	1	10.80	7.01	2.81	16.30	10.81	7.01	2.82	16.33	71.90	1.80	1.10	.00
17	CR	1323	1319	4	1	57.16	42.26	4.36	35.23	57.32	42.22	4.38	35.39	555.00	9.00	8.25	2.59
18	FE	1323	1323	0	1	30815.77	22209.64	3.63	26.60	30815.77	22209.64	3.63	26.60	300500.00	5235.00	0.00	0.00
19	HF	1323	1322	1	1	13.11	8.87	5.29	60.87	13.12	8.86	5.30	60.98	152.40	1.70	1.00	0.00
20	K	1324	1321	3	0	16537.00	3961.99	.42	5.91	16569.89	3905.77	.53	5.82	43650.00	4447.00	4103.67	698.20
21	LA	1323	1214	109	1	31.33	29.97	7.61	71.91	31.92	30.46	7.85	72.77	377.00	4.00	49.51	45.58
22	MG	1324	1319	5	0	15704.65	7185.59	1.10	5.40	15758.60	7145.47	1.13	5.45	66010.00	3246.00	2950.40	500.90
23	MN	1324	1324	0	0	516.18	244.45	1.38	6.53	516.18	244.45	1.38	6.53	2071.00	94.00	0.00	0.00
24	NA	1324	1324	0	0	11252.42	5445.97	1.33	4.43	11252.42	5445.97	1.33	4.43	31550.00	1345.00	0.00	0.00
25	SC	1323	1323	0	1	7.74	3.12	1.02	5.30	7.74	3.12	1.02	5.30	26.30	1.70	0.00	0.00
26	SR	1324	384	940	0	273.47	310.17	2.72	15.86	659.84	346.37	2.25	15.97	3538.00	192.00	231.27	48.98
27	TH	1323	1321	2	1	9.04	3.69	1.87	13.08	9.05	3.68	1.90	13.20	41.00	1.90	1.25	.05
28	TI	1321	1321	0	3	4620.05	2123.79	2.62	13.52	4620.05	2123.79	2.62	13.52	20810.00	1238.00	0.00	0.00
29	V	1324	1324	0	0	87.24	70.43	7.87	133.91	87.24	70.43	7.87	133.91	1512.00	15.00	0.00	0.00
30	ZN	1316	1013	303	8	73.82	52.02	2.58	19.47	88.77	49.96	3.22	24.93	617.00	19.00	47.70	25.67
31	TU	1321	1321	0	3	3.28	.95	.43	5.85	3.28	.95	.43	5.85	10.10	.01	0.00	0.00

NUMBER OF SAMPLES = 1324

Table 3-5 -- Statistical Summary of Stream Sediments from the Socorro 1- by 2-degree quadrangle. (Michael E. Madson, Bendix: Field Engineering, Corp., 1983).

VAR	TOTAL	NADL	NBDL	MISS	FOR TOTAL ANALYSES: MEAN	STD.DEV.	SKEWNESS	KURTOSIS	FOR ABOVE DETECTION LIMIT ANALYSES: MEAN	STD.DEV.	SKEWNESS	KURTOSIS	MAXIMUM	MIN(ADL)	DETECT. LIMIT MEAN	DETECT. LIMIT STDEV
1 U	1100	1100	0	8	2.38	.45	3.35	39.30	2.38	.45	3.35	39.30	7.80	.10	0.00	0.00
2 AG	1108	15	1093	0	1.02	.24	17.45	373.61	2.60	1.36	2.35	7.56	7.00	2.00	2.00	0.00
3 CU	1108	1108	0	0	18.89	47.51	22.85	544.49	18.89	47.51	22.85	544.49	1239.00	2.00	0.00	0.00
4 NB	1108	1092	16	0	7.78	2.94	8.84	183.42	7.87	2.87	9.61	201.81	70.00	4.00	4.00	0.00
5 NI	1108	1106	2	0	13.09	5.53	6.22	98.28	13.12	5.51	6.30	99.69	111.00	2.00	2.00	0.00
6 PB	1108	991	117	0	18.05	8.25	2.10	20.88	19.59	7.32	3.38	33.31	110.00	10.00	10.00	0.00
7 SN	0	0	0	1108	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8 ZR	1108	1108	0	0	60.61	12.43	.62	7.77	60.61	12.43	.62	7.77	151.00	12.00	0.00	0.00
9 MO	1108	12	1096	0	2.02	.22	9.77	99.45	4.08	.28	2.07	10.09	5.00	4.00	4.00	0.00
10 BE	1108	1096	12	0	1.08	.32	4.38	33.73	1.09	.31	4.42	35.44	5.00	1.00	1.00	0.00
11 LI	1108	1108	0	0	22.60	6.24	1.31	7.23	22.60	6.24	1.31	7.23	66.00	6.00	0.00	0.00
12 AL	1108	1108	0	0	4.58	.96	-.09	3.42	4.58	.96	-.09	3.42	8.05	.73	0.00	0.00
13 BA	1108	1108	0	0	498.35	95.51	1.52	14.37	498.35	95.51	1.52	14.37	1303.00	66.00	0.00	0.00
14 CA	1108	1108	0	0	2.16	2.00	2.51	13.56	2.16	2.00	2.51	13.56	19.35	.17	0.00	0.00
15 CE	1108	1106	2	0	44.41	10.58	.02	4.43	44.48	10.45	.09	4.29	106.00	10.00	10.00	0.00
16 CO	1108	1006	102	0	5.70	1.89	.10	3.36	6.07	1.55	.82	3.73	13.00	4.00	4.00	0.00
17 CR	1108	1108	0	0	25.43	7.17	1.54	14.21	25.43	7.17	1.54	14.21	97.00	4.00	0.00	0.00
18 FE	1108	1108	0	0	1.78	.45	.19	3.54	1.78	.45	.19	3.54	3.78	.23	0.00	0.00
19 HF	1108	105	1003	0	8.73	4.21	4.04	22.00	20.49	5.83	1.87	6.90	44.00	15.00	15.00	0.00
20 K	1108	1108	0	0	1.41	.29	-.43	3.35	1.41	.29	-.43	3.35	2.34	.22	0.00	0.00
21 LA	1108	1108	0	0	19.92	5.02	.53	8.22	19.92	5.02	.53	8.22	63.00	2.00	0.00	0.00
22 MG	1108	1108	0	0	.63	.39	2.56	13.04	.63	.39	2.56	13.04	3.78	.14	0.00	0.00
23 MN	1108	1108	0	0	348.62	120.00	1.40	11.57	348.62	120.00	1.40	11.57	1436.00	71.00	0.00	0.00
24 NA	1108	1108	0	0	.69	.18	1.01	8.21	.69	.18	1.01	8.21	2.14	.06	0.00	0.00
25 SC	1108	1108	0	0	4.25	1.22	.41	3.48	4.25	1.22	.41	3.48	9.00	1.00	0.00	0.00
26 SR	1108	1108	0	0	155.19	150.26	7.38	69.47	155.19	150.26	7.38	69.47	2138.00	50.00	0.00	0.00
27 TH	1108	977	131	0	5.64	3.26	.90	5.65	6.26	2.97	1.23	7.28	25.00	2.00	2.00	0.00
28 TI	1108	1108	0	0	2122.20	428.66	-.19	3.99	2122.20	428.66	-.19	3.99	3928.00	385.00	0.00	0.00
29 V	1108	1108	0	0	46.70	11.26	.49	4.64	46.70	11.26	.49	4.64	100.00	9.00	0.00	0.00
30 ZN	1108	1108	0	0	44.93	16.21	1.91	12.55	44.93	16.21	1.91	12.55	167.00	6.00	0.00	0.00
31 TU	0	0	0	1108	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

NUMBER OF SAMPLES = 1108

Table 3-6 -- Statistical summary of stream sediments from the Ft. Sumner 1- by 2-degree quadrangle. (Michael E. Madson, Bendix Field Engineering, Corp., 1983).

VAR		TOTAL	NADL	NBDL	MISS	FOR TOTAL ANALYSES: MEAN	STD.DEV.	SKEWNESS	KURTOSIS	FOR ABOVE DETECTION LIMIT ANALYSES: MEAN	STD.DEV.	SKEWNESS	KURTOSIS	MAXIMUM	MIN(ADL)	DETECT. LIMIT MEAN	DETECT. LIMIT STDEV
1	U	5094	5094	0	8	3.27	6.52	61.52	4139.06	3.27	6.52	61.52	4139.06	445.10	.10	0.00	0.00
2	AG	5097	72	5025	5	2.24	1.04	14.83	509.61	6.69	5.45	4.48	28.78	43.00	2.00	4.35	1.24
3	CU	5097	4955	142	5	21.79	26.71	31.05	1227.09	22.27	26.94	31.09	1218.15	1239.00	2.00	10.00	0.00
4	NB	5097	1163	3934	5	9.83	3.49	9.34	133.35	9.37	7.22	4.82	32.98	81.00	4.00	19.93	1.02
5	NI	5097	2508	2589	5	13.22	13.70	30.83	1582.56	19.13	17.67	28.15	1121.42	742.00	2.00	14.99	.36
6	PB	5097	4269	828	5	14.67	29.02	20.40	609.91	16.96	31.19	19.40	539.78	1103.00	5.00	5.71	1.74
7	SN	3989	64	3925	1113	5.17	2.03	27.20	1043.55	15.63	12.03	4.83	30.42	95.00	10.00	10.00	0.00
8	ZR	1108	1108	0	3994	60.61	12.43	.62	7.77	60.61	12.43	.62	7.77	151.00	12.00	0.00	0.00
9	MO	1108	12	1096	3994	2.02	.22	9.77	99.45	4.08	.28	3.09	10.09	5.00	4.00	4.00	0.00
10	BE	5098	4914	184	4	1.79	.89	2.62	22.54	1.84	.87	2.86	24.77	14.00	1.00	1.00	0.00
11	LI	5098	5098	0	4	30.29	14.16	2.32	14.34	30.29	14.16	2.32	14.34	194.00	2.00	0.00	0.00
12	AL	5102	5102	0	0	50206.31	11673.59	.37	3.43	50206.31	11673.59	.37	3.43	107900.00	7300.00	0.00	0.00
13	BA	5102	5066	36	0	555.86	225.28	4.82	48.78	559.12	222.70	5.04	51.01	3761.00	46.00	194.50	79.28
14	CA	5102	5090	12	0	22034.57	20205.54	3.53	24.80	22084.67	20202.92	3.53	24.83	262400.00	1700.00	1560.08	******
15	CE	5101	5098	3	1	59.99	27.11	5.54	74.91	60.02	27.09	5.56	75.20	619.00	10.00	8.33	2.36
16	CO	5101	4997	104	1	7.89	4.56	4.04	33.15	8.01	4.53	4.18	34.35	71.90	.90	3.96	.31
17	CR	5098	5070	28	4	41.44	27.53	5.97	72.96	41.64	27.47	6.02	73.74	555.00	4.00	11.50	3.73
18	FE	5101	5101	0	1	21817.71	15059.70	4.81	46.76	21817.71	15059.70	4.81	46.76	300500.00	2300.00	0.00	0.00
19	HF	5101	4097	1004	1	12.64	8.28	4.16	39.94	13.91	8.79	3.95	36.74	152.40	1.70	14.99	.44
20	K	5102	5095	7	0	15731.31	3698.79	.43	4.87	15747.98	3672.86	.48	4.81	43650.00	2200.00	7190.71	******
21	LA	5099	4984	115	3	30.97	20.57	7.88	100.06	31.14	20.49	8.15	103.66	377.00	2.00	47.43	45.26
22	MG	5102	4965	137	0	9663.38	6326.64	1.66	7.25	9875.72	6280.38	1.70	7.37	66010.00	1400.00	3936.20	******
23	MN	5102	5102	0	0	438.11	242.51	5.65	102.15	438.11	242.51	5.65	102.15	6394.00	61.00	0.00	0.00
24	NA	5102	5102	0	0	9370.85	4281.11	1.68	6.71	9370.85	4281.11	1.68	6.71	31550.00	600.00	0.00	0.00
25	SC	5101	5101	0	1	6.40	2.86	1.92	11.10	6.40	2.86	1.92	11.10	34.10	1.00	0.00	0.00
26	SR	5101	1642	3459	1	179.15	192.14	4.95	41.26	296.34	303.92	2.69	15.41	3538.00	50.00	247.04	62.67
27	TH	5101	4968	133	1	9.38	5.23	4.91	65.83	9.60	5.12	5.38	72.78	113.00	1.90	1.99	.09
28	TI	5094	5094	0	8	3709.92	1765.85	2.54	15.76	3709.92	1765.85	2.54	15.76	21460.00	385.00	0.00	0.00
29	V	5102	5095	7	0	64.52	44.13	9.72	245.31	64.60	44.11	9.74	246.05	1512.00	9.00	14.14	8.31
30	ZN	5049	3792	1257	53	57.89	54.56	19.58	807.97	69.92	57.81	21.39	835.49	2497.00	6.00	43.19	22.11
31	TU	3991	3991	0	1111	3.17	.76	.31	6.89	3.17	.76	.31	6.89	10.10	.01	0.00	0.00

NUMBER OF SAMPLES = 5102

Table 3-7 -- Statistical summary of stream sediments from the 4 1- by 2-degree quadrangle area (Albuquerque, Santa Fe, Socorro, and Ft. Sumner). (Michael E. Madson, Bendix Field Engineering, Corp., 1983).

Table 3-8—Statistical summary of uranium in water samples from the Albuquerque, Santa Fe, Socorro, and Ft. Sumner quadrangles by delayed neutron counting or fluorometry.

Quad.	Number of samples	NADL	NBDL	MISS	MAX U (ppb)	MIN U (ppb)	MEAN	STD. DEV.
Albuquerque	317	300	17	0	94.84	0.02	2.86	8.10
Santa Fe	851	851	0	0	161.33	0.01	4.48	11.23
Socorro	624	624	0	0	157.20	0.10	5.02	12.13
Ft. Sumner	447	441	6	169	3,078.00	0.56	30.88	151.21

Table 3-9—Statistical summary of stream sediments and water samples from the Scholle area by semiquantitative emission spectrometry (Pierson and others, 1982). Uranium analyses were determined by fluorimetry.

Element	Detection limit	NADL	NBDL	MISS	Max.	Min.	Mean	STD DEV.
Stream-sediment samples (ppm)								
Au	10	0	0	92	—	—	—	—
Ag	0.5	0	0	92	—	—	—	—
B	10	91	0	1	20	10	11	3.4
Ba	20	92	0	0	700	100	601	140
Be	1	92	0	0	15	5	11	2.9
Bi	10	0	0	92	—	—	—	—
Cd	20	0	0	92	—	—	—	—
Co	5	89	0	3	15	5	9	2.7
Cr	10	92	0	0	200	10	54	32.4
Cu	5	92	0	0	50	5	18	6.4
La	20	92	0	0	150	20	73	27.4
Nb	10	88	0	4	20	10	12	4.9
Ni	5	91	0	1	50	5	15	6.2
Pb	10	92	0	0	70	10	38	12.4
Sn	10	2	0	90	50	15	0.7	5.4
Sr	100	92	0	0	1,000	100	304	141
V	10	92	0	0	30	10	18	3.6
W	50	0	0	92	—	—	—	—
U	1	1	91	0	1	—	—	—
Th	100	0	0	0	92	—	—	—
Water samples (ppb)								
U	50	45	5	0	66,000	100	7,148	11,015

Table 3-10—Statistical summary of stream sediments from the Manzano Wilderness study (Maxwell and Wobus, 1982b). The analyses were determined by semiquantitative spectrography except for As and W (colorimetric method) and Au and Ag (atomic absorption). Concentrations determined by semiquantitative spectrography are reported as approximate midpoints of the data.

Element	Detection limit	NADL[1]	NBDL[2]	Miss[3]	Mean	S.D.[4]	Maximum	Minimum
Au	0.05	4	46	30	—	—	1.7	0.25
Ag	0.05	30	25	23	.15	0.28	1.5	0.5
Mn	10	80	0	0	863	384	2000	50
B	10	79	1	0	49	112	1000	10
Ba	20	80	0	0	665	213	1000	200
Be	1	80	0	0	1.7	0.4	3	1
Co	5	80	0	0	13	6	30	5
Cr	10	80	0	0	73	77	700	20
Cu	5	80	0	0	38	16	70	15
La	20	78	2	0	61	23	150	20
Ni	5	80	0	0	22	9	50	7
Pb	10	80	0	0	35	14	70	10
Sc	5	80	0	0	12	5	30	5
Sr	100	80	0	0	169	34	300	100
V	10	80	0	0	71	29	200	30
W	50	0	56	24	—	—	10	2
Y	10	80	0	0	41	17	100	15
Zr	10	80	0	0	488	287	1000	150

[1] NADL - number of samples above detection limit.
[2] NBDL - number of samples below detection limit.
[3] MISS - number of samples not analyzed.
[4] S.D. - Standard deviation

APPENDIX 4

Geochemical Anomalies from NURE HSSR Geochemical Data

Introduction

The following compilation of geochemical anomalies from NURE HSSR geochemical data is a brief description of each of the geochemical anomalies shown on Figure 8 and described in the section entitled "Interpretation of the NURE geochemical data". Each description is a brief account of the location, potential commodities, geochemical and geophysical features, structural features, and geology of each anomaly. These anomalies may or may not indicate economic mineralization.

Explanation of descriptions

The descriptions of the geochemical anomalies in this section consist of 14 entries or less and the entries are listed by number and discribed below.

1: 1- by 2-degree Quadrangle and anomaly number.

2: County.

3: Author of anomaly report.

4: Date of anomaly report.

5: Location of anomaly by geographic area or mining district, latitude and longitude of the center of the anomaly area, and township and range.

6: Anomalous geochemical elements (strong anomalies underlined).

7: Aerial radiometric features from aerial radiometric open-file reports (Table 1).

8: Aerial magnetic features from magnetic contour maps generated by Bendix Field Engineering Corp. (Figure 23).

9: Structural features.

10: Formation name and age of host rock.

11: Type of mineralizaiton found or expected to be found in the area.

12: References cited as described in Appendix 1.

13: Comments on origin, economic significance, or other information.

14: Recommendations.

Mineral Resource Potential of Torrance County - Figure 8

1: Ft. Sumner #A
2: Torrance
3: V. T. McLemore
4: 5/2/84
5: Estancia valley; center 34°35'N, 105°54'W, 8 mi north-south and 3 mi east-west; T 4, 5N, R 9,10E
6: U 5-10 ppm, Sr 200-2,000 ppm, Li 50-100 ppm in stream sediments;
U in lake waters 0.5-334 ppb, well waters 0.17-37 ppb
7: few high eU; however, most eU are average, elevated eU/eTh
8: on the north flank of a gravity high and on the west flank of a magnetic high
9: playa lakes in closed basin
10: Quaternary playa deposit
11: uranium in playa lake deposits
12: Brookins and Olson (1977)
13: best explained by evaporative concentration of ground waters anomalously high in U, probably no economic significance
14: none

1: Socorro #B
2: Torrance
3: V. T. McLemore
4: 5/2/84
5: east side of Manzano Mountains; center 34°39'N, 106°22'W, 9 mi northwest-southeast, 4 mi northeast-southwest; T 5N, R 5,6 E
6: U 5-10 ppm, Pb 50-200 ppm, Co 10-50 ppm, W 10-50 ppm, Ni 20-50 ppm, Cr 100 ppm, Zn 100-200 ppm, Cs 5-10 ppm, Lu 5-1.0 ppm, La 50-100 ppm in stream sediments
7: anomalously high eU and eU/eTh upstream from this cluster
8: magnetic high, along a northwest trending saddle between two gravity highs (parallel to the cluster)
9: various faults associated with the uplift of the Manzano Mountains
10: Permian Abo or Yeso Formation
11: one occurrence of stratabound copper-uranium mineralization in or near this cluster (McCandless, 5N.5E.34), mining claims also occur in the area
13: may be due to (1) copper-uranium deposits in Permian rocks, (2) shales in the Madera Group, (3) sulfide deposits in Precambrian rocks, or (4) analytical error because some of these anomalies are close to the detection limit

1: Socorro #C
2: Torrance
3: V. T. McLemore
4: 5/2/84
5: east side of Manzano Mountains; 106°11'N, 34°45'W; 9 mi northwest-southeast, 3 mi northeast-southwest; T 6,7N, R 6,7E
6: U 5-10 ppm, Zn 100-200 ppm, Co 10-50 ppm
9: various faults associated with the uplift of the Manzano Mountains
10: Pennsylvanian Madera Group, Permian Bursum Formation
13: one mining claim in the area but no known mineralization; trend of cluster parallels cluster B
14: additional study is warranted

1: Socorro #D
2: Torrance, Socorro, Valencia
3: V. T. McLemore
4: 5/2/84
5: Scholle district; center at 34°28'N, 106°24'W, 10 mi east-west by 10 mi north-south; T 2,3N, R 4,5E
6: U 5-10 ppm, Co 10-50 ppm, Ag 2-5 ppm, Bi 5-10 ppm, Zn 100-200 ppm, W 10-50 ppm, Nb 50-100 ppm, Li 50-100 ppm, Sn 20-50 ppm in stream sediments; U in water samples
8: south of a gravity high
10: Permian Bursum and Abo Formations
11: stratabound copper-uranium sedimentary deposits with associated silver, lead, and gold
12: Planner (1980); Pierson and others (1982); Field notes (1980-1984)
13: possibly related to copper deposits and also may indicate sources of sandstones

1: Socorro #E
2: Valencia
3: V. T. McLemore
4: 5/2/94
5: west of Manzano Mountains; center at 34°35'N, 106°33'W; 12 mi north-south, 2 mi east-west; T 4,5N, R 3E
6: Co 10-50 ppm, Cs 5-10 ppm, Zn 100-500 ppm, Lu 0.5-1 ppm in stream sediments
7: very high eK anomalies in the Manzano Mountains east of this cluster
8: along a magnetic low
9: faulting associated with the Manzano uplift
10: Precambrian metasedimentary rocks
11: small precious and base metals veins in the Manzano Mountains
12: Maxwell and Wobus (1981a, b); Maxwell and Light (1984); field notes (1/26/84)
13: area east of this cluster classified as having a low to moderate mineral resource potential for gold
14: follow-up studies warranted because these anomalies may indicate base and/or precious metals deposits

1: Socorro #F
2: Torrance, Valencia
3: V. T. McLemore
4: 5/2/84
5: Manzano Mountains, south of Hells Canyon mining district (gold); center at 34°50'N, 106°23'W; T 7N, R 4E
6: a few stream-sediment samples in the area enriched in La 50-100 ppm, Lu 0.5-1 ppm, U 5-10 ppm, Th 20 ppm, Zn 100-200 ppm, Co 5-10 ppm, Li 50-100 ppm, Co 10-50 ppm, Cr 50-200 ppm, and Ni 20-50 ppm
7: high eU and eU/eTh in the extreme southern part of area F near anomalous sample with high U and Th, high eK in area
8: south flank of gravity high
9: numerous faults
10: Precambrian greenstones, metavolcanic, and metasedimentary rocks, Ojita granitic pluton
11: gold and massive sulfides deposits in Precambrian greenstones in the Hells Canyon mining district
12: Woodward and others (1978); Edwards (1978); field notes (9/28/83)
13: may indicate potential base and/or precious metals deposits, in area classified as having a moderate mineral resource potential for gold and massive sulfides in Precambrian greenstones
14: warrants further study

1: Santa Fe #G
2: Santa Fe, Torrance
3: V. T. McLemore
4: 5/2/84
5: center at 35°10'N, 103°45'W; 30 mi long east-west; T 9N, R 9-14 E
6: Pb 50-200 ppm, Ba 1,000-2,000 ppm, Zn 100-200 ppm, Nb 50-100 ppm, Ce 100-200 ppm, La 50-100 ppm, Lu 0.5-1 ppm, Sr 200-6,000 ppm, and W 10-50 ppm in stream sediments; high K values
7: a few scattered high eK anomalies
8: most anomalies cluster on magnetic high and very few anomalies on the adjacent magnetic low
9: reverse or thrust fault at El Cuervo Butte
10: Triassic and Permian sediments
11: one barite-fluorite-galena with silver vein in the cluster (El Cuervo Butte)
12: Williams and others (1965); field notes (12/15/83)
13: this large cluster may represent additional barite-fluorite-galena veins or indicate that the sediments were derived from feldspar-rich rocks
14: warrants further study

1: Albuquerque #H
2: Torrance, Santa Fe
3: V. T. McLemore
4: 5/2/84
5: center at 35°10'N, 106°6'W; 11 mi east-west; T 9N, R 7,8E
6: Li 50-100 ppm, Lu 0.5-1 ppm in stream sediments
8: south of a magnetic high
10: Pennsylvanian Madera Group
11: barite-fluorite vein along fault in the area
12: Levinson (1974, table 2-1); Williams and others (1965)
13: probably related to lithium-rich shales
14: no additional studies needed

1: Fort Sumner/Socorro #I
2: Torrance
3: V. T. McLemore
4: 5/2/84
5: center at 34°56'N, 106°2'W; 14 mi northeast-southwest, 4 mi northwest-southeast; T 8,9N, R7-9E
6: Co 10-50 ppm, W 10-200 ppm, Cs 5-10 ppm, Zn 100-200 ppm, Sn 10-20 ppm, and Sr 200-2,000 ppm in stream sediment. One Mo 4 ppm anomaly
10: Precambrian metamorphics, Quaternary valley fill and alluvium
11: no known mineralization
13: significance of this cluster is unknown

1: Fort Sumner #J
2: Torrance
3: V. T. McLemore
4: 5/2/84
5: Lobo Hill; center at 34°53'N, 105°30'W; 10 mi east-west, 8 mi north-south; T 7,8N, R 9-11E
6: Ag 2-5 ppm, Sr 200-2,000 ppm, Li 50 ppm, Co 20-50 ppm in stream sediments
7: few scattered high eTh anomalies
8: south flank of a very strong magnetic high
10: carbonatite intrudes Paleozoic syenites in Precambrian metamorphic rocks
11: silver bearing quartz vein in vicinity of the carbonatite
12: Field notes (9/20/83)
13: may be related to the carbonatite and/or silver-quartz veins
14: additional geologic mapping and geochemical sampling required

1: Fort Sumner #K
2: Torrance
3: V. T. McLemore
4: 5/2/84
5: center at 34°35'N, 105°30"W; T 5-7N, R 12-15E
6: mostly isolated single point anomalies Pb 50-200 ppm, Zn 100-200 ppm, Ag 2-5 ppm, and Cu 50-50,000 ppm in stream sediments although this area has a low sample density
10: Precambrian metamorphics and granite, Permian sediments, Ogallala Formation (Tertiary)
11: uranium associated with syenite in Precambrian rocks, copper mineralization along faults in Precambrian rocks
12: Field notes (9/21/84)
13: It is difficult to adequately interpret single anomalies could be representative of mineralization

1: Fort Sumner #L
2: Torrance
3: V. T. McLemore
4: 5/2/84
5: near Duran; center at 34°29'N, 105°28'W; 10 mi square; T 2-4N, R 14,15E
6: Co 10-50 ppm, Cu 50-5,000 ppm, Pb 50-100 ppm, and Zn 100-200 ppm in stream sediments, many represent point anomalies rather than a cluster
8: decreasing north-south trending magnetic contours
9: several faults that have exposed a Precambrian outlier
10: Precambrian granite, Permian Yeso Formation, Tertiary intrusives, Tertiary Ogallala Formation
11: one occurrence of corundum in the Precambrian granite
12: Kelley (1972)
13: possible mineralization but no additional information is available
14: warrants study on a low priority status

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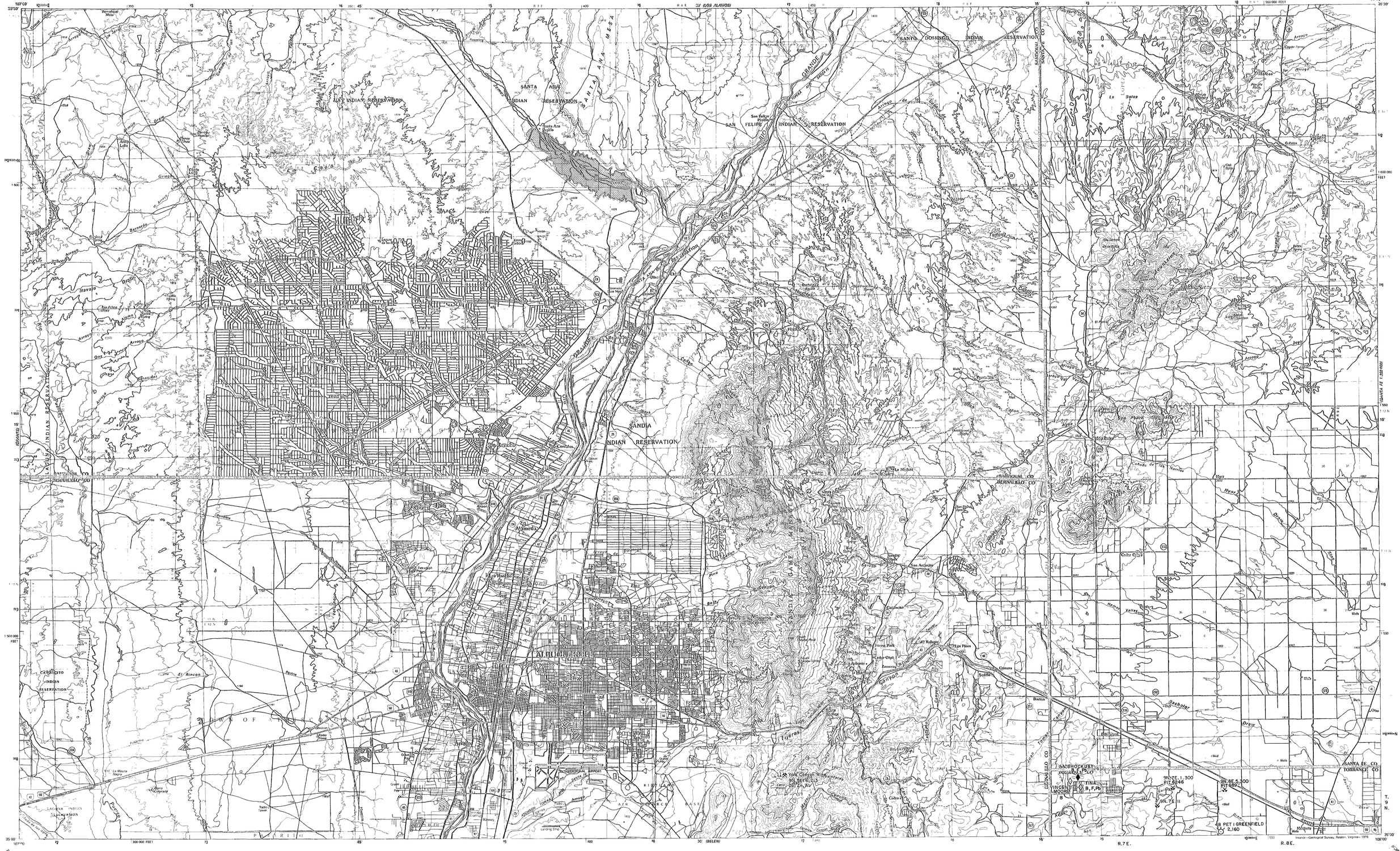
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Figure 11 - Mineral and other commodity occurrences, deposits, and mines and oil and gas tests in the Albuquerque 1:100,000 quadrangle, Torrance County

Figure 11
ALBUQUERQUE QUADRANGLE
NEW MEXICO
1:100 000-SCALE SERIES (TOPOGRAPHIC)
OF - 192

192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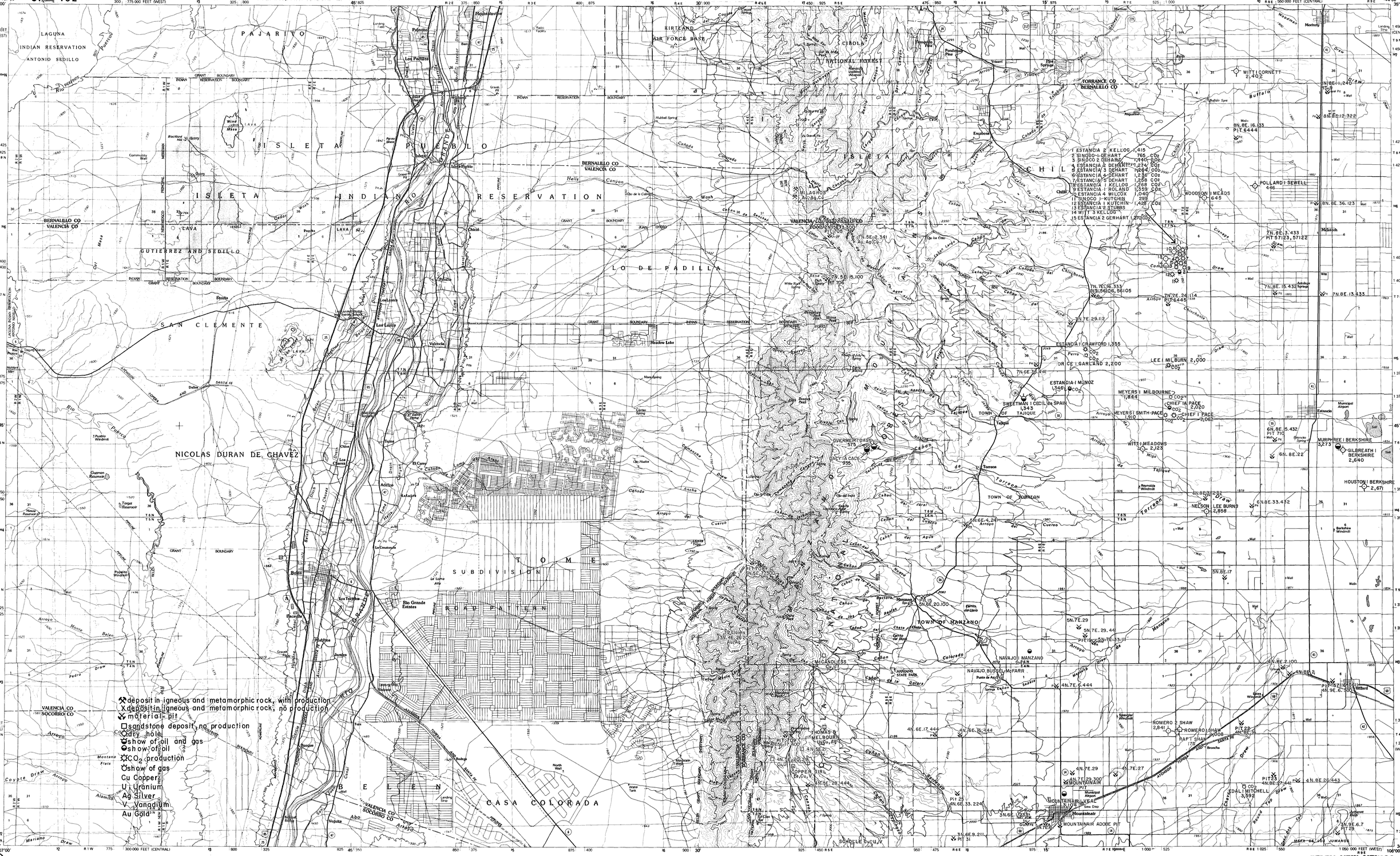
SANTA ANA MESA
SANTO DOMINGO INDIAN RESERVATION
SAN FELIPE INDIAN RESERVATION
SANDIA INDIAN RESERVATION
ALAMEDA INDIAN RESERVATION
CANONCITO INDIAN RESERVATION
LAGUNA INDIAN RESERVATION
ALBUQUERQUE
INTERNATIONAL AIRPORT
KIRTLAND AIR FORCE BASE
RIO GRANDE
RIO PUERCO
SANDIA MOUNTAINS
MANZANO MOUNTAINS
LOS PINOS MOUNTAINS
SANDOVAL CO
BERNALILLO CO
TORRANCE CO
SANTA FE CO
VALENCIA CO
CIBOLA CO
McKINLEY CO
SAN JUAN CO
Yeso Canyon Mine
SN SE 13 T 9 N R 7 E Au
SN SE 1, 300 PIT 6246
SN SE 5,500 PIT 6897
SN 7E 11
SAIS HOCKUBEY
VINCENT MOORE
TINA
B, F, Pb
48 PET I GREENFIELD 2,160
Tijeras
Barton
Otto
Los Pinos
Comuna
Sedillo
Cedro
Escabosa
Chical Hoco
San Antonio
Torreon Park
Lake Roberts
Low Pilos
Cedro Chijil
Lemora
Tijeras Canyon
Tijeras Arroyo
Arroyo de los Montoyas
Arroyo de la Cabeza
Arroyo de las Huertas
Arroyo de los Pinos
Arroyo de los Piños
Arroyo de los Tanos
Arroyo de los Frijoles
Arroyo de los Chamisos
Arroyo de los Duranes
Arroyo de los Gallos
Arroyo de los Montoy

Figure 12 - Mineral and other commodity occurrences, deposits, and mines and oil and gas tests in the Belen 1:100,000 quadrangle, Torrance County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PAJARITO
KIRTLAND AIR FORCE BASE
CIBOLA NATIONAL FOREST
ISLETA INDIAN RESERVATION
ISLETA PUEBLO
LO DE PADILLA
CHILILI
GUTIERREZ AND SEDILLO
SAN CLEMENTE
NICOLAS DURAN DE CHAVEZ
SUBDIVISION
TOME
BELEN
CASA COLORADA
BERNALILLO CO
VALENCIA CO
SOCORRO CO
TORRANCE CO
BERNALILLO CO
1 ESTANCIA 2 KELLOG 1,415
2 SINCO-1-DEHART 765 CO2
3 SINCO 2 DEHART 1,440 CO2
4 ESTANCIA 4 DEHART 1,274 CO2
5 ESTANCIA 3 DEHART 1,264 CO2
6 ESTANCIA 4-DEHART 1,238 CO2
7 ESTANCIA 5 DEHART 1,258 CO2
8 ESTANCIA 1 KELLOG 1,268 CO2
9 ESTANCIA 1 ROLAND 1,359 CO2
10 ESTANCIA 4 WILCOX 1,040
11 SINCO 1-KUTCHIN 299
12 ESTANCIA 1 KUTCHIN 1,428 CO2
13 ESTANCIA 2 STUBBS
14 WITT 3 KELLOG
15 ESTANCIA 2 GERHART 1,270 CO2
WITT CORNETT 2,402
POLLARD SEWELL 496
WOODSON MEADS 645
ESTANCIA CRAWFORD 1,355
LEE MILBURN 2,000
ESTANCIA MUNOZ 1,546
SWEETMAN CECIL DE SPAIN 1,343
TOWN OF TAJIQUE
MEYERS MILBOURNE 1,844
CHIEF PACE 2,020
MEYERS SMITH-PACE 1,910
CHIEF PACE 2,062
WITT MEADOWS 2,123
MURPHREE BERKSHIRE 3,273
GILBREATH BERKSHIRE 2,640
HOUSTON BERKSHIRE 2,671
NELSON LEE BURNS 2,656
TOWN OF TORREON
TOWN OF MANZANO
NAVAJO MANZANO
NAVAJO BUSSEL MCFARR
McCANDLESS
THOMAS MELBOURNE
COPPER GIRL
SCHOLLE
OVERMEYER OASIS
SALT CACHE
ROMERO SHAW 2,841
RAPT SHAW 2,908
EDAL MITCHELL 3,592
MOUNTAINAIR
MOUNTAINAIR ADOBE PIT
ATCHISON TOPEKA AND SANTA FE
RIO PUERCO
RIO GRANDE
Isleta Pueblo
Los Padillas
Los Lentes
Valencia
Meadow Lake
Belen
Jarales
Bosque Farms
Los Chavez
Tome
Adelino
Los Angeles
El Cerro
Rio Grande Estates
Manzano
Torreon
Tajique
Mountainair
Municipal Airport
Sky Ute
Estancia
Municipal Airport
Sandia Mountains
Manzano Mountains
Gallinas Mountains
Isleta Reservoir
Los Chavez Reservoir
Manzano Reservoir
Guzman Reservoir
Tome Reservoir
Pueblo Windmill
Reynolds Windmill
Berkshire Windmill
Municipal Airport
Sky Ute
Mountainair
Municipal Airport
Mountainair
Municipal Airport
Mountainair
Municipal Airport

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Figure 13
OF - 192
SOCORRO, NEW MEXICO

Figure 13 - Mineral and other commodity occurrences, deposits, and mines and oil and gas tests in the Socorro 1:100,000 quadrangle, Torrance County

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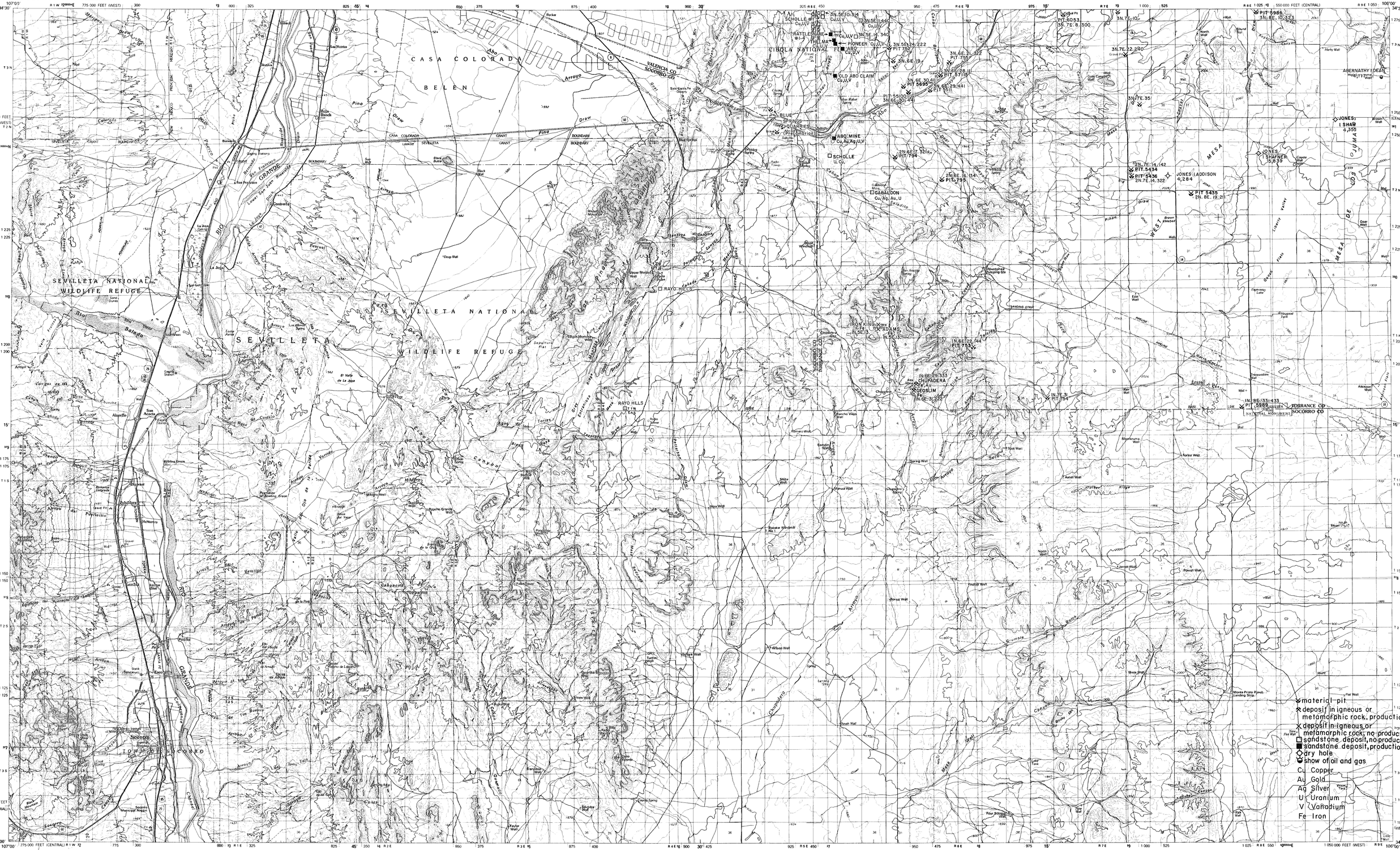
30x60 MINUTE SERIES (TOPOGRAPHIC)


CASA COLORADA
BELEN
SEVILLETA NATIONAL WILDLIFE REFUGE
CIBOLA NATIONAL FOREST
RAYO HILLS
BLUE SPRINGS QUARRIES (Precambrian)
ABO MINE Cu,Au,Ag,U,V
SCHOLLE Cu,U
GABALDON Cu,Ag,Au,U
JONES-SHAW 4,355
JONES-SHAFNER 5,839
JONES-LADDISON 4,284
ABERNATHY DEEP 5,177 ft
TORRANCE CO
SOCORRO CO
Socorro
LOWER VALLEY
RIO GRANDE
Rio Salado
Abo Arroyo
Pino Draw
Tijeras Arroyo
Chupadera Arroyo
Quebradas Canyon
Gutierrez Canyon
Canyon
Mesa
Draw
Arroyo
Wash
Spring
Well
Windmill
Tank
Ruin
Cemetery
Church
School
Campground
Picnic Area
Trail
Road
Railroad
Fence
Boundary
Contour
Index Contour
Intermediate Contour
Supplementary Contour
Depression Contour
Fault
Escarpment
Levee
Dune
Sand
Lava
Lake
Playa
Marsh
Swamp
Glacier
Perennial Stream
Intermittent Stream
Canal
Ditch
Aqueduct
Flume
Pipeline
Tramway
Power Transmission Line
Telephone Line
Aerial Cable
Pier
Wharf
Dam
Breakwater
Jetty
Seawall
Boat Ramp
Bridge
Tunnel
Building
Airport
Landing Strip
Mine
Quarry
Gravel Pit
Oil or Gas Well
Tank
Windmill
Spring
Well
Campground
Picnic Area
Cemetery
Church
School
Dam
Levee

192

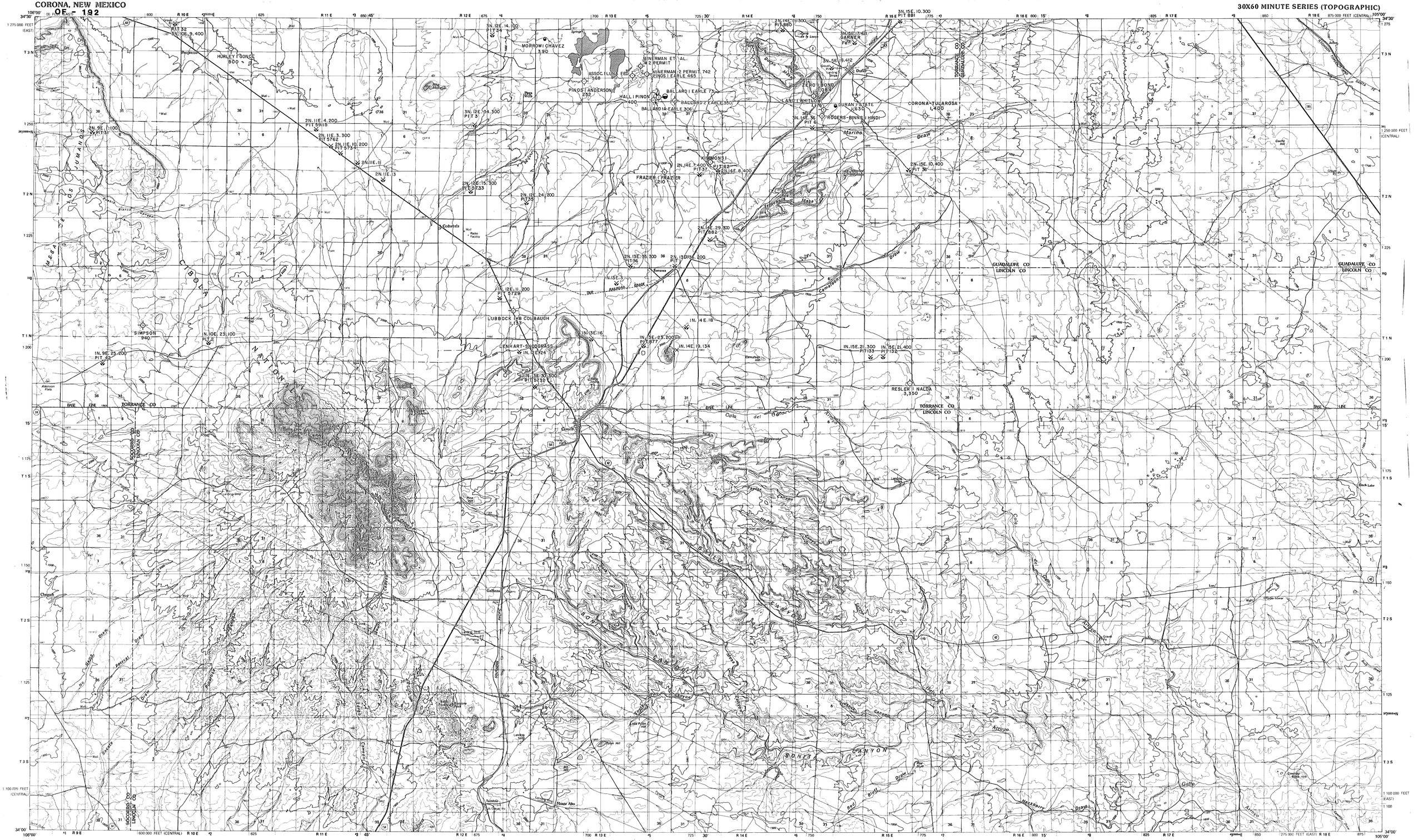
Figure 14

CORONA, NEW MEXICO
05 - 192

Figure 14 - Mineral and other commodity occurrences, deposits, and mines and oil and gas tests in the Corona 1:100,000 quadrangle, Torrance County

192

30X60 MINUTE SERIES (TOPOGRAPHIC)



SCALE 1:100 000
1 CENTIMETER ON THE MAP REPRESENTS 1 KILOMETER ON THE GROUND
CONTOUR INTERVAL 20 METERS

KILOMETERS 1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
MILES 1 0 1 2 3 4 5 6 7 8 9 10 11 12 13

1000 0 5000 10 000 15 000 20 000 METERS
5000 0 10 000 20 000 30 000 40 000 50 000 60 000 70 000 FEET

- material pit
- dry hole
- show of oil and gas
- show of oil

CORONA, NEW MEXICO
N3400-W10500/30x60
1980

© INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1981

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Figure 15

Figure 15 - Mineral and other commodity occurrences, deposits, and mines and oil and gas tests in the Vaughn 1:100,000 quadrangle, Torrance County

192

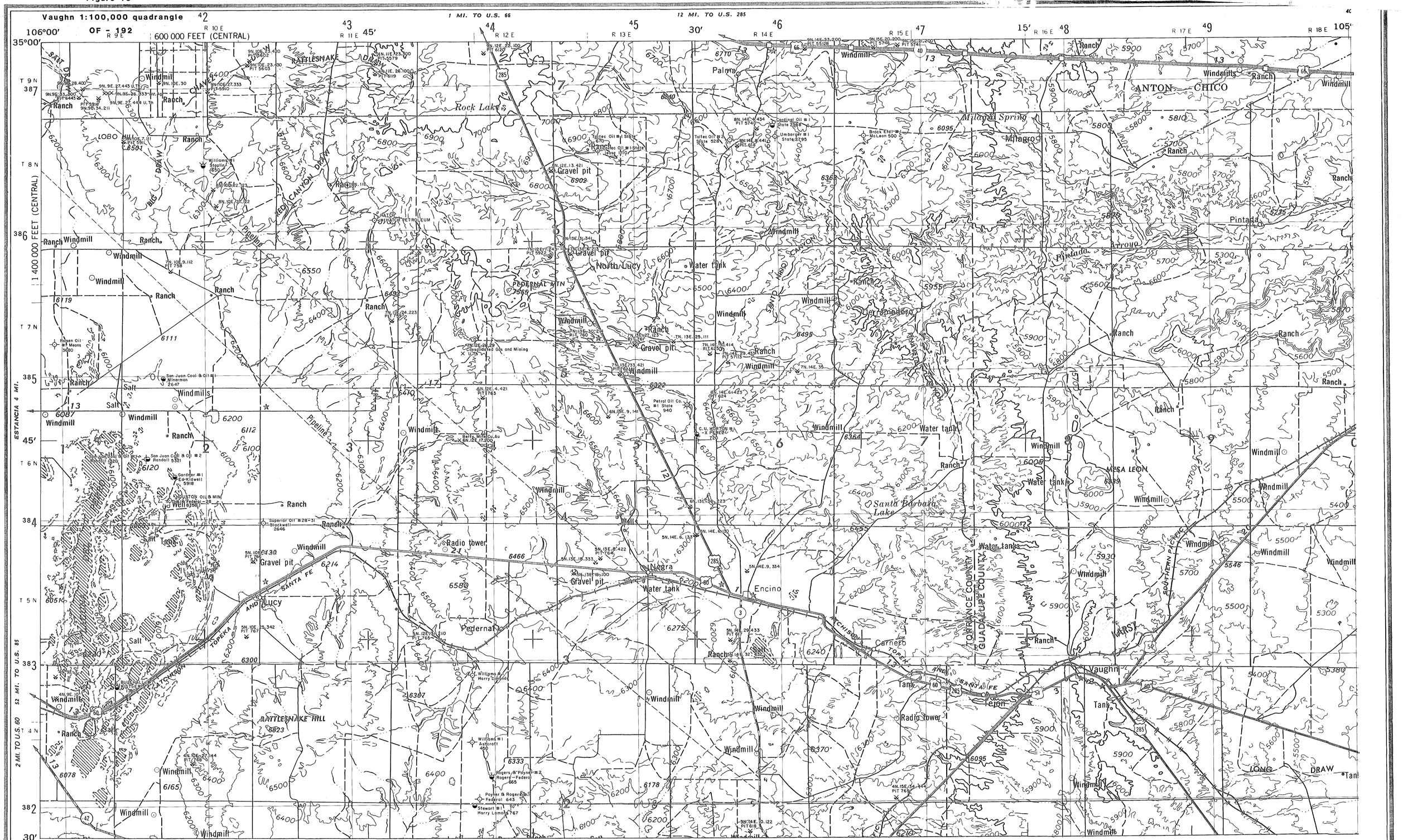
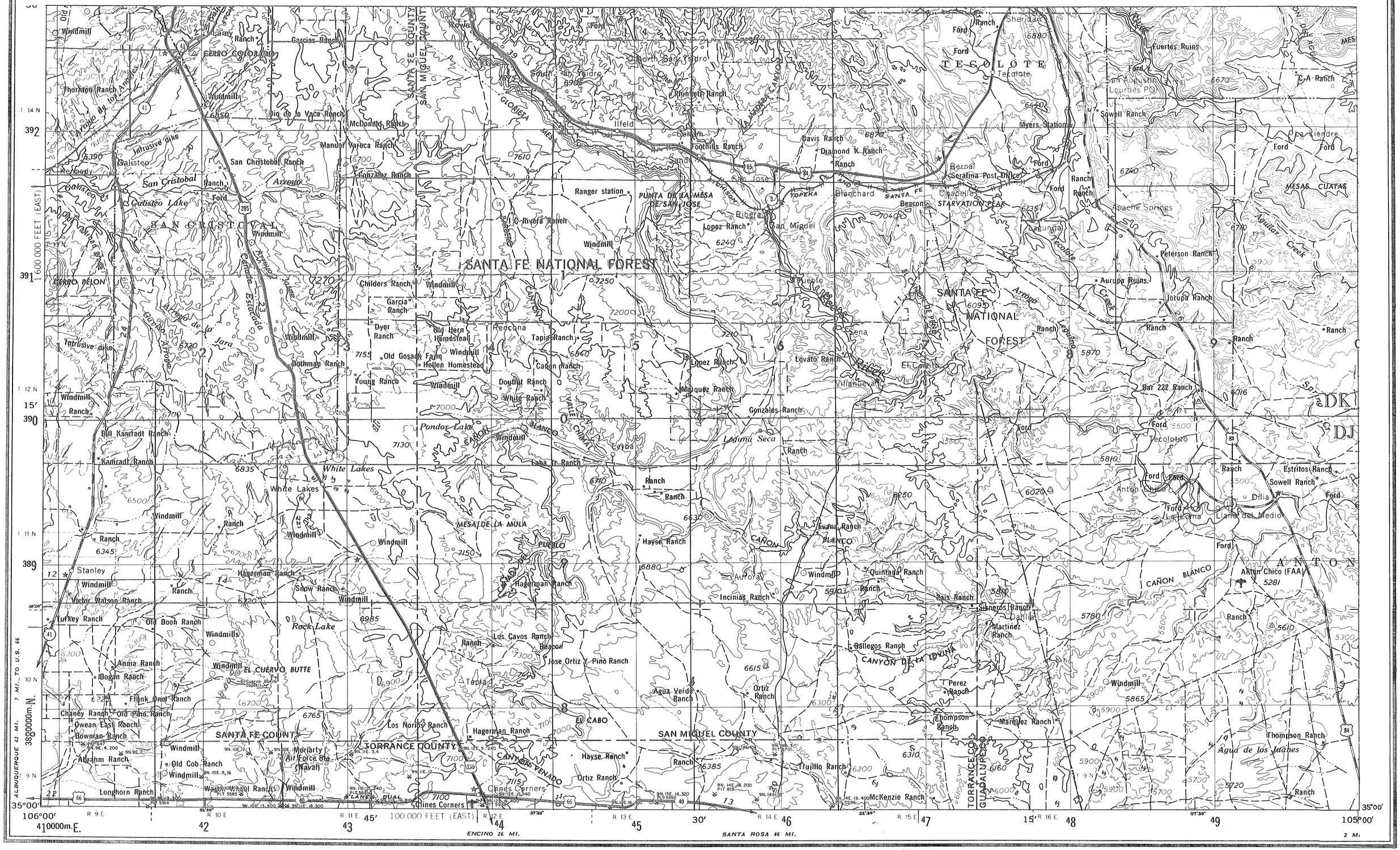

Vaughn 1:100,000 quadrangle
OF - 192
106°00'
35°00'
600 000 FEET (CENTRAL)
1 400 000 FEET (CENTRAL)
1 MI. TO U.S. 66
12 MI. TO U.S. 285
2 MI. TO U.S. 60
52 MI. TO U.S. 85
ESTANCIA 4 MI.
R 9 E
R 10 E
R 11 E
R 12 E
R 13 E
R 14 E
R 15 E
R 16 E
R 17 E
R 18 E
T 9 N
T 8 N
T 7 N
T 6 N
T 5 N
T 4 N
Rock Lake
Palma
Windmill
Ranch
Gravel pit
Water tank
Windmills
Salt
Radio tower
Water tanks
Tank
Pipeline
Milagro Spring
Milagros
ANTON CHICO
Pintada
Arroyo
Hermanos
North Lucy
Pedernal
Negra
Encino
Cerneros
Vaughn
Lucy
Mesa Leon
Santa Barbara Lake
Lake
Canyon
Draw
Creek
Hill
Mtn
Pedernal Mtn
Rattlesnake Hill
Rattlesnake Draw
Lobo Draw
Big Draw
Red Canyon Draw
Long Draw
Sand Draw
Torrance County
Guadalupe County
Santa Fe
Topeka and Atchison
Atchison
Topeka
Southern Pacific
Lucy
Salt
Ranch
Windmill
Windmills
Gravel pit
Water tank
Radio tower
Water tanks
Tank
Pipeline
Milagro Spring
Milagros

Figure 16

Figure 16 - Mineral and other commodity occurrences, deposits, and mines and oil and gas tests in the Villanueva 1:100,000 quadrangle, Torrance County

Villanueva 1:100,000 quadrangle

OF - 192



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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Figure 17 - Mineral resource potential (excluding aggregate resources) of the Albuquerque 1:100,000 quadrangle

Figure 17
ALBUQUERQUE QUADRANGLE
NEW MEXICO
1:100 000-SCALE SERIES (TOPOGRAPHIC)
OF - 192

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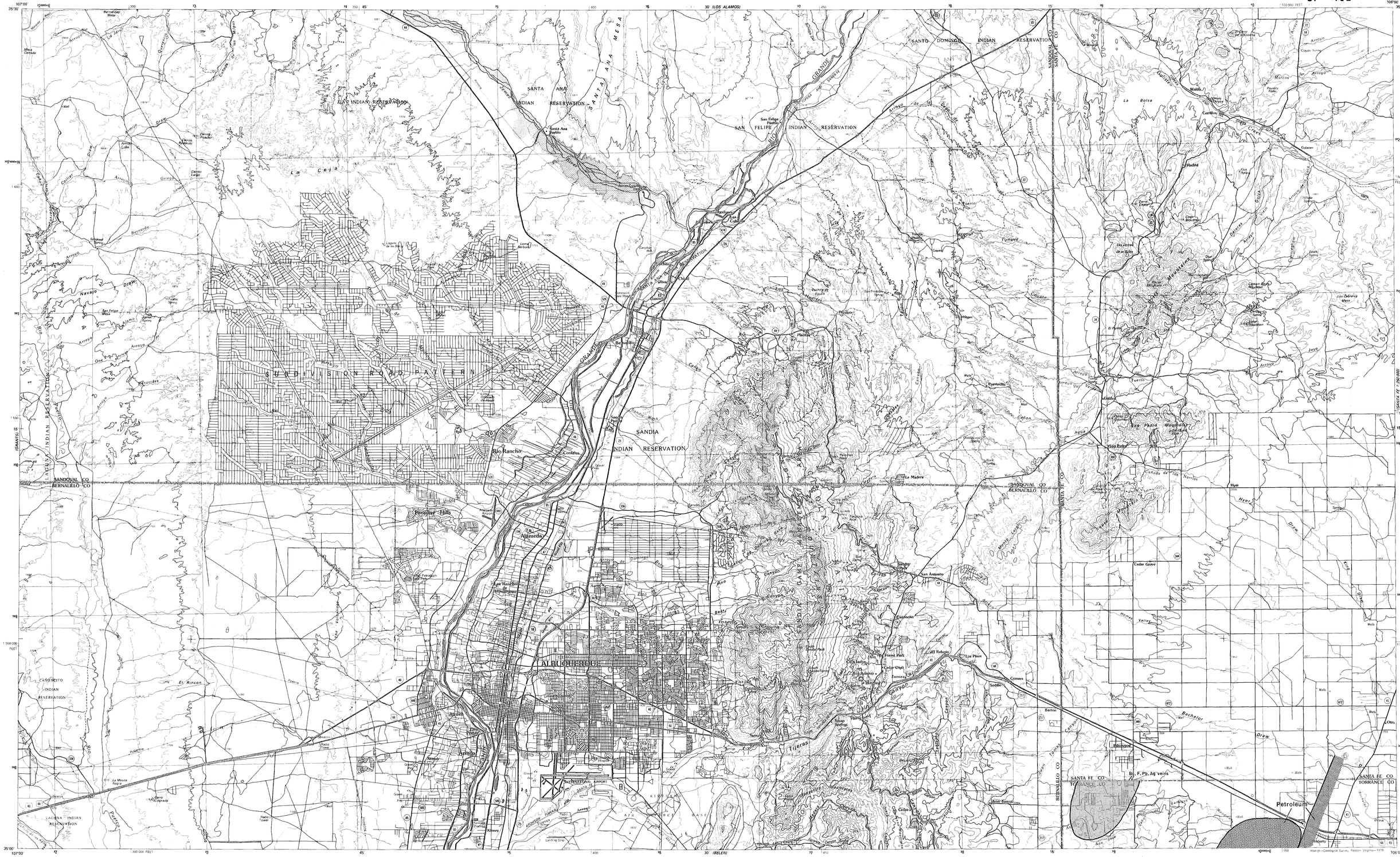

Mapped, edited, and published by the Geological Survey

Compiled from USGS 1:24 000 and 1:62 500-scale topographic maps dated 1954–1961. See index for dates of individual maps
Partially revised from aerial photographs taken 1975 and 1976 and from other official sources. Revised information not field checked
Map edited 1978

Projection and 10 000-meter grid, zone 13
Universal Transverse Mercator
50 000-foot grid ticks based on New Mexico coordinate system, central zone. 1927 North American datum

Areas covered by dashed light-blue pattern are subject to controlled inundation

Some grant boundaries adjacent to Rio Grande and Rio Puerco are omitted because of insufficient data

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1. Sky Village NW – 1960
2. Sky Village NE – 1960
3. Bernalillo NW – 1963
4. Santa Ana Pueblo – 1954
5. San Felipe Pueblo – 1954
6. Sky Village SW – 1954
7. Madrid – 1961
8. Sky Village – 1954
9. Sky Village SE – 1954 (Photorevised – 1972)
10. Bernalillo SW – 1954 (Photorevised – 1972)
11. Bernalillo – 1954 (Photorevised – 1972)
12. Placitas – 1954
13. Tonque – 1954
14. Bernalillo Ranch – 1954
15. Volcano Ranch – 1954 (Photorevised – 1972)
16. Los Griegos – 1960 (Photorevised – 1972)
17. Alameda – 1960 (Photorevised – 1972)
18. Sandia Crest – 1967 (Photorevised – 1972)
19. Sandia Park – 1954
20. Tijeras – 1954
21. Eagehead – 1956
22. La Mesita Negra – 1954 (Photorevised – 1971)
23. La Mesita Negra SE – 1954 (Photorevised – 1972)
24. Albuquerque West – 1960 (Photorevised – 1972)
25. Albuquerque East – 1960 (Photorev ised – 1972)
26. Isleta – 1954 (Photorev ised – 1972)
27. Sedillo – 1954
28. Edgewood – 1954

UTM GRID AND 1978 MAGNETIC NORTH DECLINATION AT CENTER OF MAP

SCALE 1:100 000

KILOMETERS 0 1 2 3 4 5 6 7 8 9 10

MILES 0 1 2 3 4 5

FEET 5000 0 5000 10000 15000 20000 25000

CONTOUR INTERVAL 50 METERS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

NEW MEXICO
QUADRANGLE LOCATION

MINERAL RESOURCE POTENTIAL

- Low–Moderate
- Low

LEGEND

- Perennial stream, lake
- Intermittent stream, lake
- Village or locality
- Landmark structure
- Public park or recreation area
- Forest or game land area
- Other public area or Military or Indian reservation
- Built-up area

ROAD CLASSIFICATION

- Primary highway, hard surface
- Secondary highway, hard surface
- Light-duty road, hard or improved surface
- Street or unimproved road
- Trail
- Interstate route
- U.S. route
- State route

ALBUQUERQUE, NEW MEXICO

SE/4 ALBUQUERQUE (N) 13-11 1:250 000-SCALE MAP

N3500—W10600/30x60

1978

This map complies with national map accuracy standards
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225 OR RESTON, VIRGINIA 22092

Image—Geological Survey, Reston, Virginia—1978

Figure 18

OF - 192

BELEN, NEW MEXICO

Figure 18 - Mineral resource potential (excluding aggregate resources) of the Belen 1:100,000 quadrangle

30x60 MINUTE SERIES (TOPOGRAPHIC)


Au, massive Sulfides Precambrian greenstones
Cu, Pb, Ag, Au (±U) in Precambrian rock
Cu, Pb, Ag, Au (±U) in Precambrian rocks
Cu, Ag, U in Abo
Cu, in Meseta Blanca
Cu, in Meseta Blanca
Petroleum
Petroleum
Petroleum
Halite
Halite
Halite
Halite
Petroleum
CO2
CO2
CO2
TORRANCE CO
BERNALILLO CO
BERNALILLO CO
VALENCIA CO
VALENCIA CO
VALENCIA CO
SOCORRO CO
VALENCIA CO
SOCORRO CO
BERNALILLO CO
VALENCIA CO
TOWN OF TAJIQUE
TOWN OF TORREON
TOWN OF MANZANO
ISLETA INDIAN RESERVATION
ISLETA PUEBLO GRANDE
LAGUNA INDIAN RESERVATION ANTONIO SEDILLO
NICOLAS DURAN DE CHAVEZ
GUTIERREZ AND SEDILLO
SAN CLEMENTE
LO DE PADILLA
CHILILI
PAJARITO
CIBOLA NATIONAL FOREST
KIRTLAND AIR FORCE BASE
TOME SUBDIVISION
ROAD PATTERN
CASA COLORADA
BELEN
Bio Grande Estates
Manzano Mountains
Torreon
Tajique
Mountainair
Municipal Airport
Municipal Airport
Gabaldon
Estancia
Moriarty
Willard
Los Lentes
Los Chaves
Los Padillas
Pajarito
Isleta
Isleta Pueblo
Chical
Peralta
Valencia
Belen
Los Tapias
Jarales
Bosque
Tome
Adelino
La Constancia
El Cerro
Pueblitos
Becerdas
Sabinal Siding
Vegita
Meadow Lake
Mountainair
Gran Quivira
Escabosa
Chilili
Canyon
Torreon
Manzano
Tajique
Abo
Arroyo
Draw
Wash
Canada
Rio Grande
Rio Puerco
Rio Puerco
Rio Puerco

Figure 19

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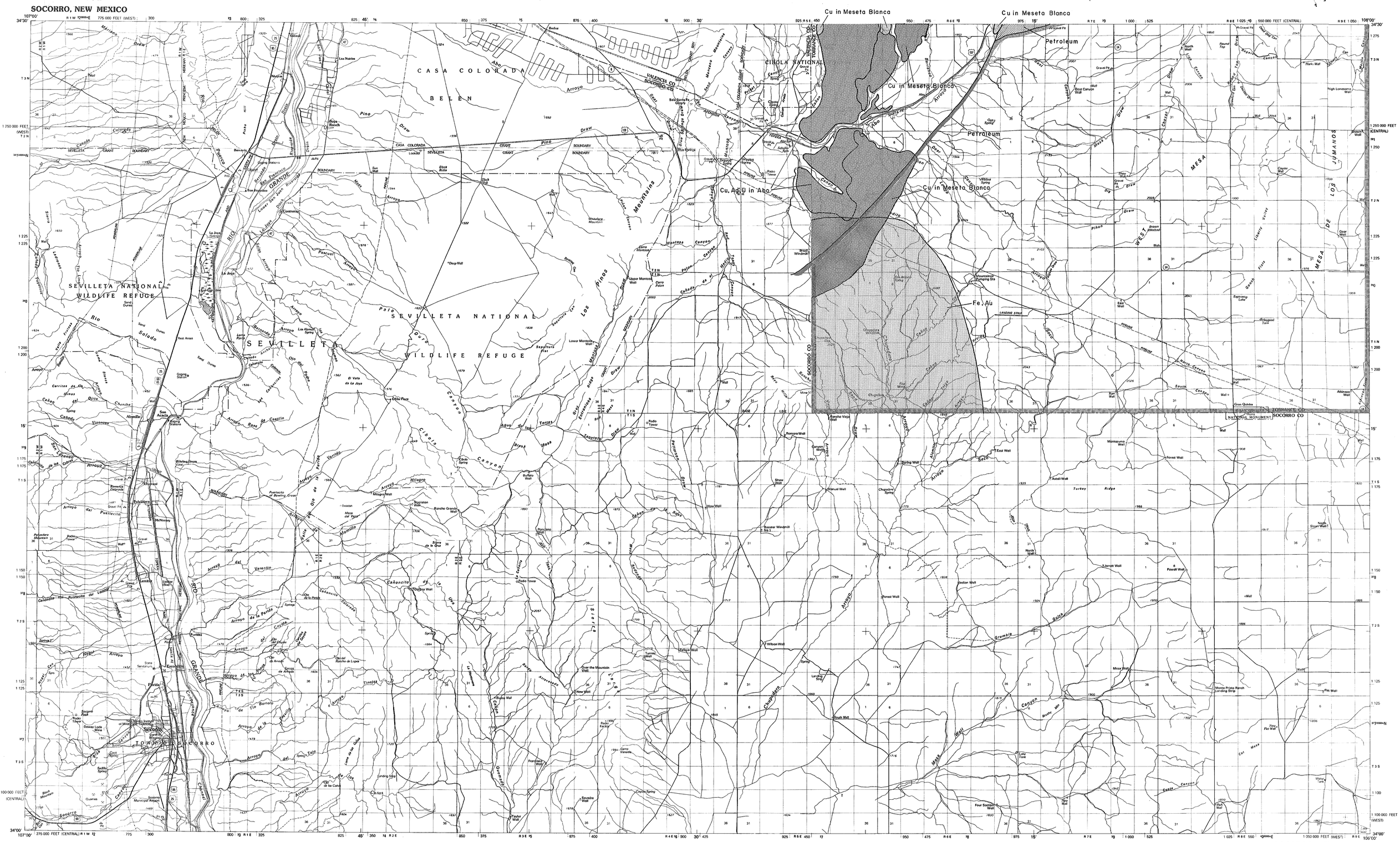
SOCORRO, NEW MEXICO

Figure 19 - Mineral resource potential (excluding aggregate resources) of the Socorro 1:100,000 quadrangle



Mineral Resource Potential

- Moderate
- Low–Moderate
- Low

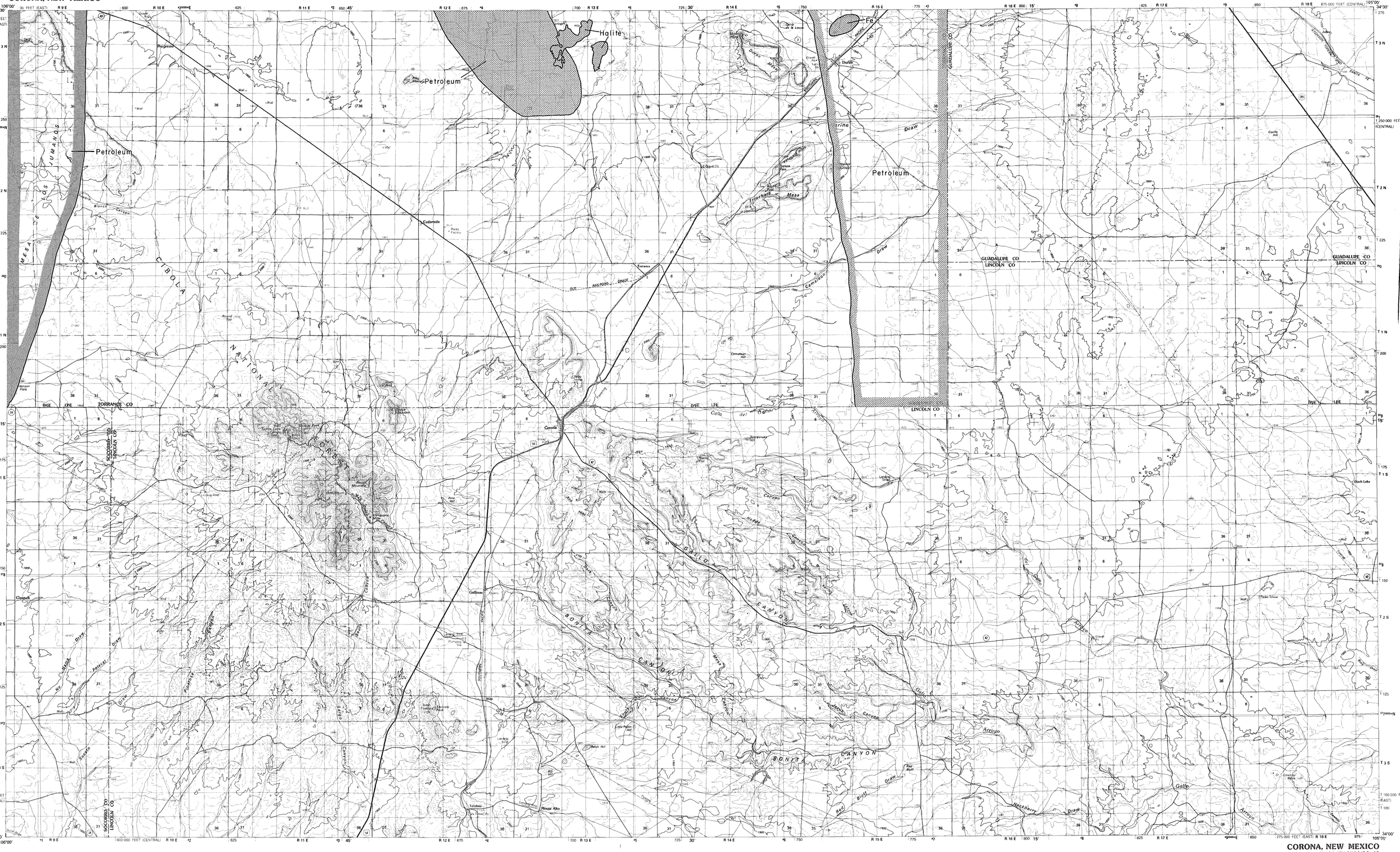
192

Figure 20
OF - 192
CORONA, NEW MEXICO

192

Figure 20 - Mineral resource potential (excluding aggregate resources) of the Corona 1:100,000 quadrangle

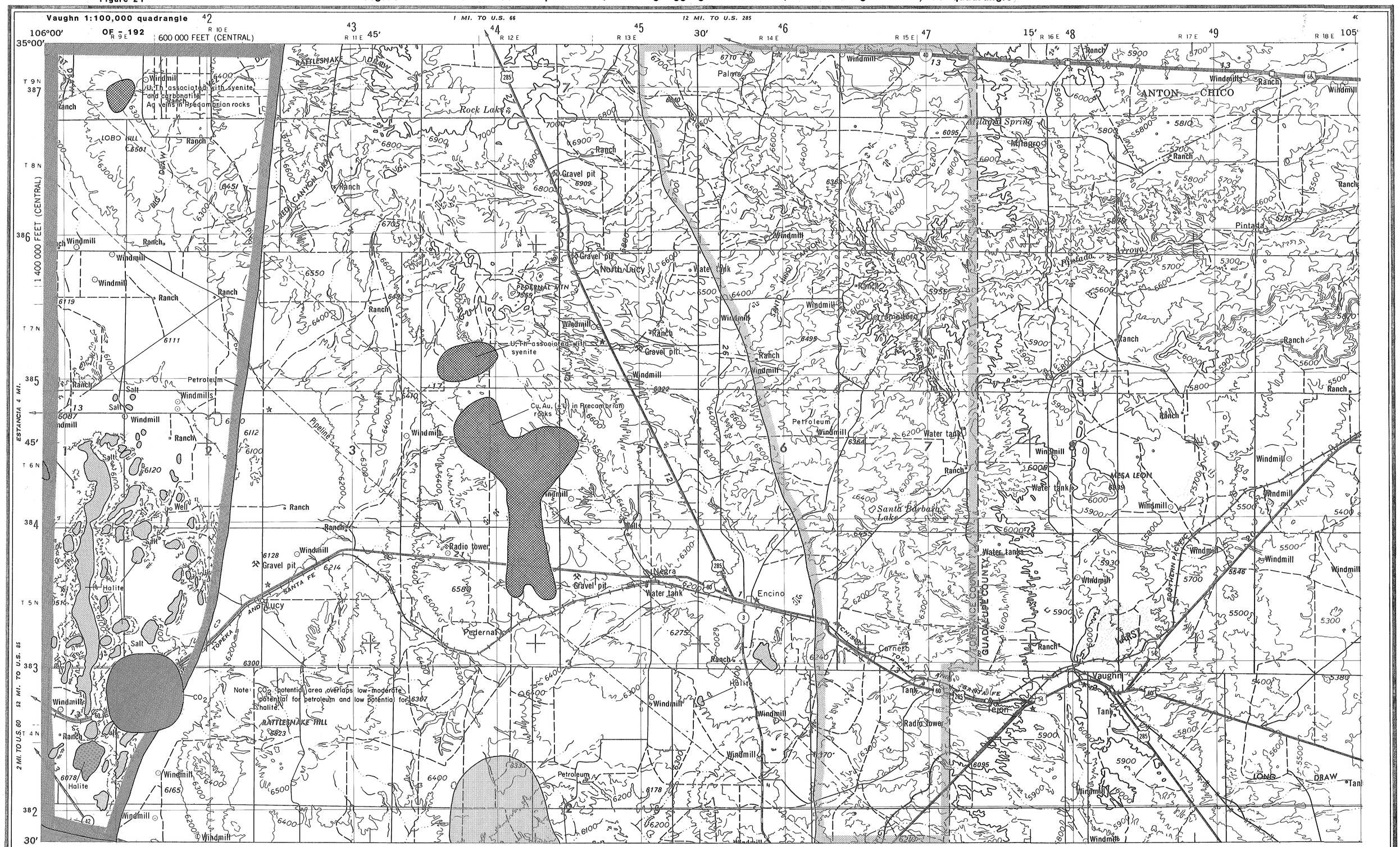
30X60 MINUTE SERIES (TOPOGRAPHIC)


Holite
Petroleum
Fe
Petroleum
Petroleum
MESA DE LOS JUMANOS
CIBOLA
NATIONAL
GUADALUPE CO
LINCOLN CO
TORRANCE CO
SOCORRO CO
LINCOLN CO
Corona
Gallinas
BONITA CANYON
GALLO CANYON
Cedarvale
Torrance
Mesa Jumanos
Trifocal Mesa
Cañoncito
Mesa Chivato
Mesa Gallina
Mesa Gallo
Mesa Bonita
Mesa Cedro
Mesa Cebolla
Mesa Cebollita
Mesa Cebollon
Mesa Cebollon
Mesa Cebollon

192

Figure 21

Figure 21 - Mineral resource potential (excluding aggregate resources) of the Vaughn 1:100,000 quadrangle



192

192

Figure 22 - Mineral resource potential (excluding aggregate resources) of the Villanueva 1:100,000 quadrangle

Villanueva 1:100,000 quadrangle

OF - 192

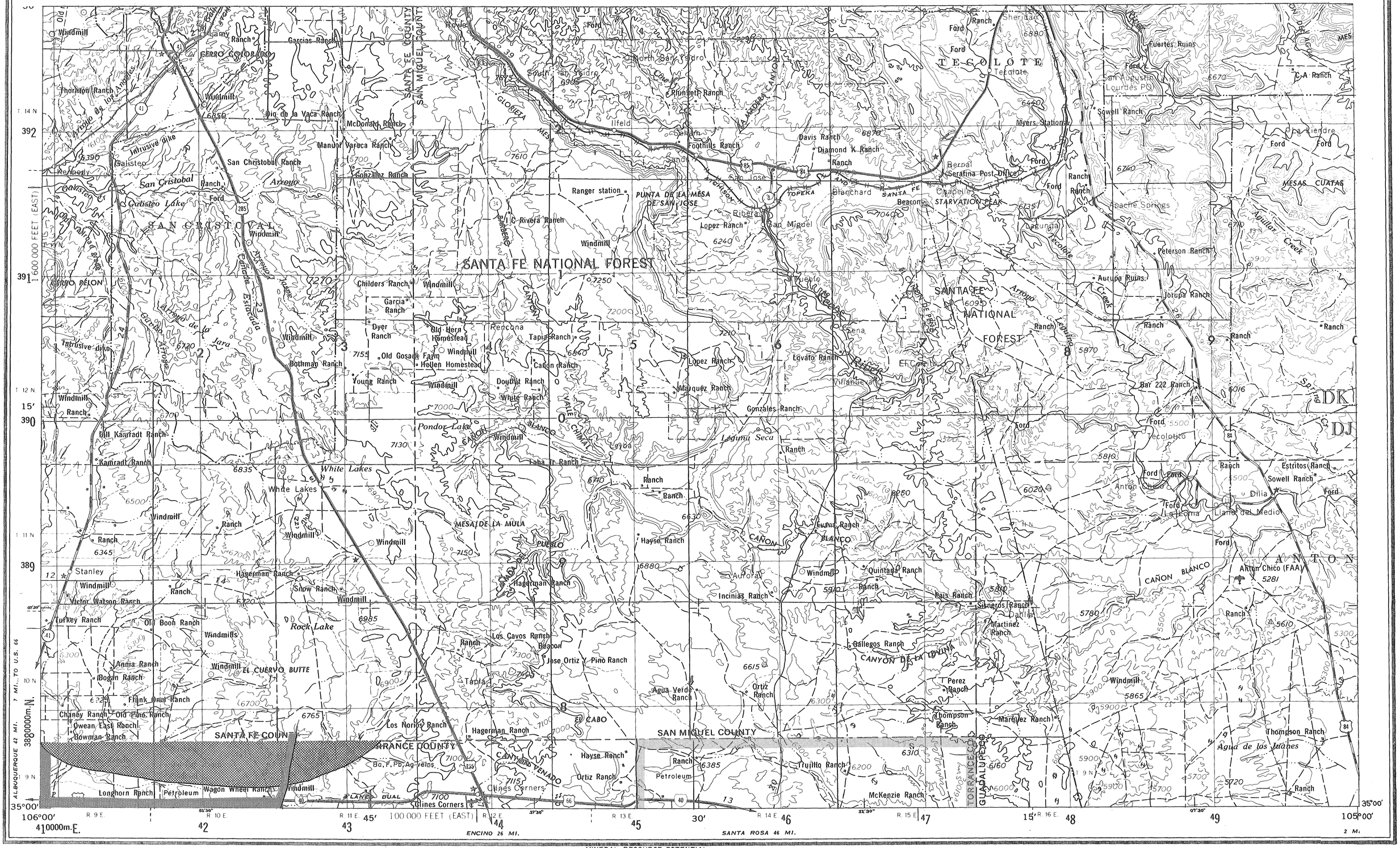

VILLANUEVA 1:100,000
SANTA FE NATIONAL FOREST
SAN CRISTOBAL
SANTIAGO NATIONAL FOREST
TECOLOTE
ANTON CHICO
SAN MIGUEL COUNTY
SANTA FE COUNTY
TORRANCE COUNTY
GUADALUPE COUNTY
Pueblo
Ranger station
Windmill
Ranch
Ford
Lopez Ranch
Ribera
San Miguel
Foothills Ranch
Davis Ranch
Diamond K Ranch
Bernal
Serafina Post Office
Blanchard
Beacon
STARVATION PEAK
Myers Station
Sowell Ranch
Peterson Ranch
Autupa Ruins
Jotupa Ranch
Fuertes Ruins
Tecolote
Sheridan
Lourdes PO
C-A Ranch
MESAS CUATAS
Apache Springs
Agua de los Juanes
Thompson Ranch
Estritos Ranch
Sowell Ranch
Dilia
Llano del Medio
Anton Chico (FAA)
5281
CAÑON BLANCO
Quintana Ranch
Sais Ranch
Sisneros Ranch
Martinez Ranch
Gallegos Ranch
CANYON DE LA LOMA
Perez Ranch
Thompson Ranch
Marquez Ranch
McKenzie Ranch
Trujillo Ranch
Petroleum
Ortiz Ranch
Agua Verde Ranch
Hayse Ranch
Aurora
Incinias Ranch
Windmill
Ranch
Jose Ortiz y Pino Ranch
Los Cavos Ranch
Rock Lake
Hagerman Ranch
Show Ranch
Victor Watson Ranch
Stanley
Turkey Ranch
Old Boon Ranch
Annis Ranch
Bogan Ranch
Frank Onel Ranch
Chaney Ranch
Old Pino Ranch
Owean East Ranch
Bowman Ranch
Longhorn Ranch
Wagon Wheel Ranch
Cline's Corners
Los Norios Ranch
Tapia
EL CUERVO BUTTE
MESA DE LA MULA
PUEBLO
CANADA DE
CANON
EL CABO
Ba, F, Pb, Ag-Velos
Rencona
Tapia Ranch
Old Horn Homestead
Old Gosaik Farm
Hollen Homestead
Garcia Ranch
Childers Ranch
Dyer Ranch
Bothman Ranch
Young Ranch
Doutlit Ranch
White Ranch
Canon Ranch
Pondor Lake
Laguna Seca
Gonzales Ranch
Leyba
Laba Jr. Ranch
White Lakes
Kamradt Ranch
Bill Kamradt Ranch
Windmill Ranch
Garcias Ranch
Thornton Ranch
Big de la Vaca Ranch
McDonald Ranch
Manuel Vareca Ranch
Gonzalez Ranch
San Christobal Ranch
Galisteo Lake
Galisteo
Intrusive dike
Arroyo
Cerro Pelon
Cerro Colorado
Ilfeld
North San Ysidro
South San Ysidro
Riinkett Ranch
Sandia
Ojo Caliente
Lopez
Lovato Ranch
Vallejos
Villanueva
El Cuartelejo
Bar 222 Ranch
Tecolotito
Ojo Feliz
Aguilar Creek
Arroyo Tecolote
Arroyo Hondo
Arroyo de la Jara
Arroyo Estrada
Arroyo Tasajo
Arroyo Cañon
Arroyo Leyendecker
Spring Creek
Canon de Pecos
Canon de Tapia
Canon de Valmi
Canon de Chimal
Canon de Venado
Canon de Blanco
Canon de Sandia
Canon de Richardson
Canon de Anderson
Canon de Topeka
Canon de Santa Fe
Canon de Glorieta
Canon de Arroyo Hondo
Mesa de Glorieta
Mesa de Pecos
Mesa de Sandia
Mesa de Richardson
Mesa de Anderson
Mesa de Topeka
Mesa de Santa Fe
Mesa



Figure 23 - Aerial magnetic contour map of the Albuquerque, Socorro, Fort Sumner, and Santa Fe 1- by 2- degree quadrangles

(Prepared by Michael E. Madson, Bendix Field Engineering, Corp., 1983.)

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Figure 25 – Favorable Geologic Units for Nonmetallic Commodities
Explanation for Figures 26–31

Qa Alluvium – recent alluvium or stream valley deposits of sand and gravel
POTENTIAL COMMODITIES-SAND AND GRAVEL

Qev Evaporites – evaporite deposit of salt and gypsum
POTENTIAL COMMODITIES-SALT AND GYPSUM

Qe Eolian deposits – dunes and other blow sands of quartz and gypsum
POTENTIAL COMMODITIES-SAND AND GYPSUM

Qt Terrace deposits – gravel capped benches between streams
POTENTIAL COMMODITY – GRAVEL

Ql Old Lake deposit – deposit of black to gray clay and silt from old lake beds
POTENTIAL COMMODITIES – NONE

Qp Pediment gravels – pediment surfaces underlain by caliche – cemented gravel with some sand
POTENTIAL COMMODITIES – SAND, GRAVEL AND CALICHE

Qc Caliche deposits with some sand and gravel
POTENTIAL COMMODITIES – SAND, GRAVEL, AND CALICHE

Ti Intrusive dikes, sills, and stocks
POTENTIAL COMMODITIES – IRON DEPOSITS (contact-metasomatic or hydrothermal)

To Ogallala Formation – pinkish sand, gravel, silt and caliche
POTENTIAL COMMODITIES – SAND, GRAVEL AND CALICHE

Trc Chinle Formation – red mudstone, red and gray sandstone and purple limestone

Trs Santa Rosa Sandstone – red to gray, irregular bedded sandstone

Pag Artesia Group Undivided – sandstone, gypsum, red mudstone and local dolomite
POTENTIAL COMMODITIES – GYPSUM

Psa San Andres Formation – light-gray to black dolomite, reddish mudstone, gypsum, and local limestone
POTENTIAL COMMODITIES – LIMESTONE, GYPSUM, DIMENSION STONE

Pg Glorieta Sandstone – light-gray to white sandstone with dolomite and limestone tongues
POTENTIAL COMMODITY – HIGH SILICA SAND

Py Yeso Formation – tan, reddish yellow, gray and white sandstone, siltstone, dolomite, gypsum, and limestone
POTENTIAL COMMODITIES – GYPSUM, LIMESTONE, BARITE–FLUORITE VEINS, STRATABOUND COPPER DEPOSITS

Pa Abo Formation – red mudstone and sandstone, minor limestones
POTENTIAL COMMODITIES – STRATABOUND COPPER DEPOSITS

Pb Bursum Formation – red brown arkose, red and gray shale and olive-gray calcarenite
POTENTIAL COMMODITY – DIMENSION STONE

IPm Madera Group Undivided – gray limestone, drak-gray calcarenite, and green shales, gray, greenish and reddish-brown sandstone with conglomerate
POTENTIAL COMMODITIES – HIGH-CA LIMESTONE, LIMESTONE

IPs Sandia Formation – dark-gray limestone, black shale, and brownish sandstone with local conglomerate

p€g Precambrian granite and granite gneiss
POTENTIAL COMMODITY – DIMENSION STONE

p€ Precambrian rocks undivided
POTENTIAL COMMODITY – DIMENSION STONE

QUATERNARY

TERTIARY

TRIASSIC

PERMIAN

PRECAMBRIAN PENNSYLVANIAN

U / T D Fault – dotted where concealed
U upthrown side
D downthrown side
T thrust fault

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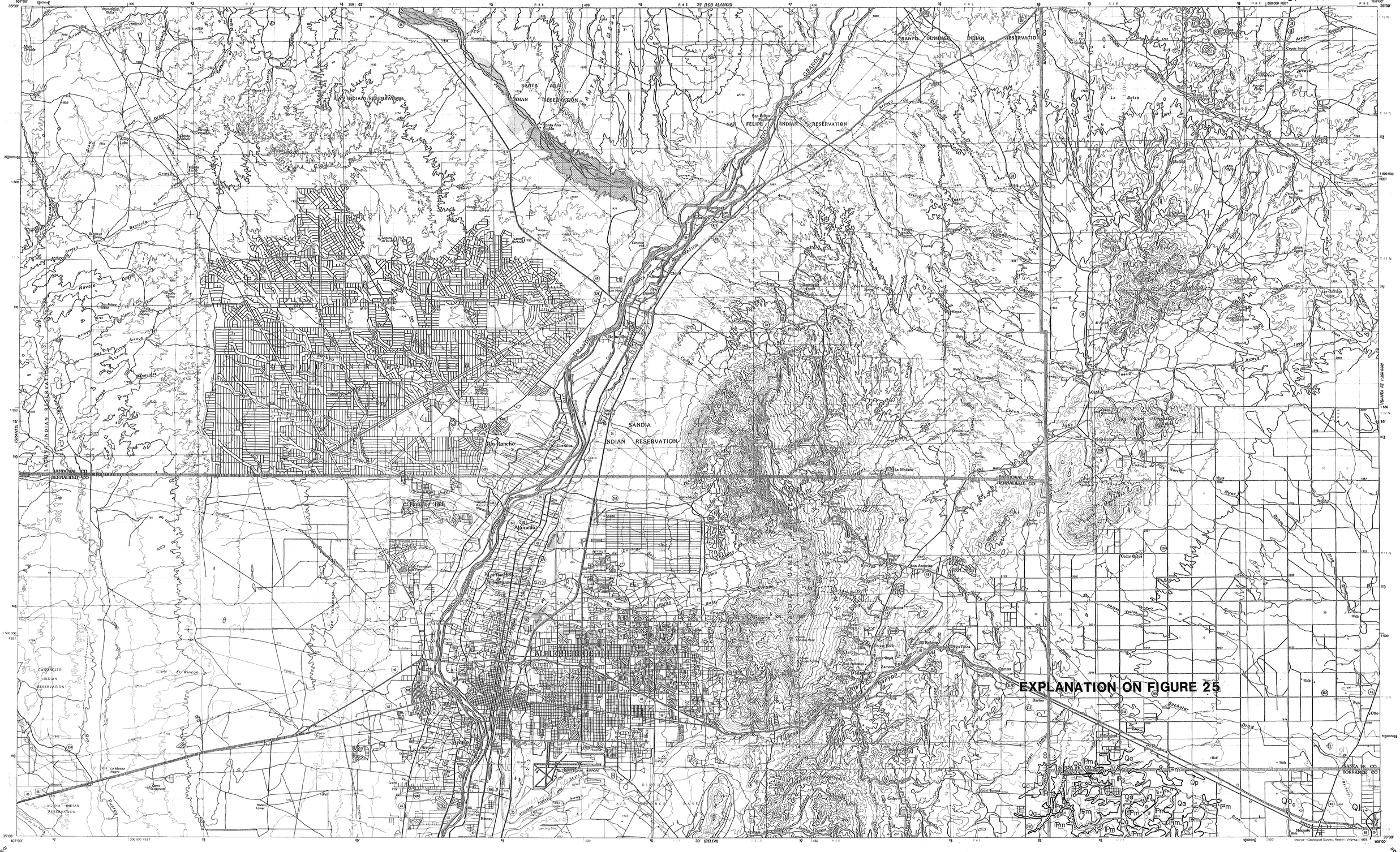
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Figure 26 - Favorable geologic formations for nonmetallic commodities in the Albuquerque 1:100,000 quadrangle, Torrance County



Mapped, edited, and published by the Geological Survey

Compiled from USGS 1:24 000 and 1:62 500-scale topographic maps dated 1954–1961. See index for dates of individual maps
Partially revised from aerial photographs taken 1975 and 1976 and from other official sources. Revised information not field checked
Map edited 1978

Projection and 10 000-meter grid, zone 13
Universal Transverse Mercator
50 000-foot grid ticks based on New Mexico coordinate system, central zone. 1927 North American datum

Areas covered by dashed light-blue pattern are subject to controlled inundation

Some grant boundaries adjacent to Rio Grande and Rio Puerco are omitted because of insufficient data

INDEX TO 1:24 000 AND 1:62 500-SCALE MAPS

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						21
22	23	24	25	26	27	28

1 Sky Village NW – 1960
2 Sky Village NE – 1960
3 Bernalillo NW – 1953
4 Santa Ana Pueblo – 1954
5 San Felipe Pueblo – 1954
6 Bernalillo Pueblo NE – 1954
7 Madrid – 1961
8 Sky Village – 1954
9 Sky Village SE – 1954 (Photorevised – 1972)
10 La Cueva – 1954 (Photorevised – 1972)
11 Bernalillo – 1954 (Photorevised – 1972)
12 Placitas – 1954
13 Hagan – 1954
14 Bernardo Ranch – 1954
15 Volcano Ranch – 1954 (Photorevised – 1972)
16 Los Griegos – 1960 (Photorevised – 1972)
17 Alameda – 1960 (Photorevised – 1972)
18 Sandia Crest – 1961 (Photorevised – 1972)
19 Sandia Park – 1954
20 Cedro Peak – 1954
21 Edgewood – 1956
22 La Mesita Negra – 1954 (Photorevised – 1971)
23 La Mesita Negra SE – 1954 (Photorevised – 1972)
24 Albuquerque West – 1960 (Photorevised – 1972)
25 Albuquerque East – 1960 (Photorevised – 1972)
26 Tijeras – 1956 (Photomap – 1972)
27 Sedillo – 1954
28 Edgewood – 1954

UTM GRID AND 1978 MAGNETIC NORTH DECLINATION AT CENTER OF MAP

SCALE 1:100 000

KILOMETERS 0 1 2 3 4 5 6 7 8 9 10
MILES 0 1 2 3 4 5
FEET 5000 0 5000 10000 15000 20000 25000

CONTOUR INTERVAL 50 METERS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

NEW MEXICO

QUADRANGLE LOCATION

LEGEND

- Perennial stream, lake
- Intermittent stream, lake
- Village or locality
- Landmark structure
- Public park or recreation area
- Forest or game land area
- Other public area or Military or Indian reservation
- Built-up area

ROAD CLASSIFICATION

- Primary highway, hard surface
- Secondary highway, hard surface
- Light-duty road, hard or improved surface
- Street or unimproved road
- Trail
- Interstate route
- U.S. route
- State route

ALBUQUERQUE, NEW MEXICO

SE/4 ALBUQUERQUE (NI 13-11) 1:250 000-SCALE MAP

This map complies with national map accuracy standards
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092

N3500—W10600/30x60
1978
Imprint—Geological Survey, Reston, Virginia—1978

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Figure 27

BELEN, NEW MEXICO
OF 192

Figure 27 - Favorable geologic formations for nonmetallic commodities in the Belen 1:100,000 quadrangle, Torrance County

30x60 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION ON FIGURE 25

SCALE 1:100 000

1 CENTIMETER ON THE MAP REPRESENTS 1 KILOMETER ON THE GROUND

CONTOUR INTERVAL 50 METERS

SUPPLEMENTARY CONTOUR INTERVAL 25 METERS

BELEN, NEW MEXICO
N3430-W10600/30x60
1979

192

192 Figure 28
SOCORRO, NEW MEXICO
OF-192

Figure 28 - Favorable geologic formations for nonmetallic commodities in the Socorro 1:100,000 quadrangle, Torrance County

30x60 MINUTE SERIES (TOPOGRAPHIC)

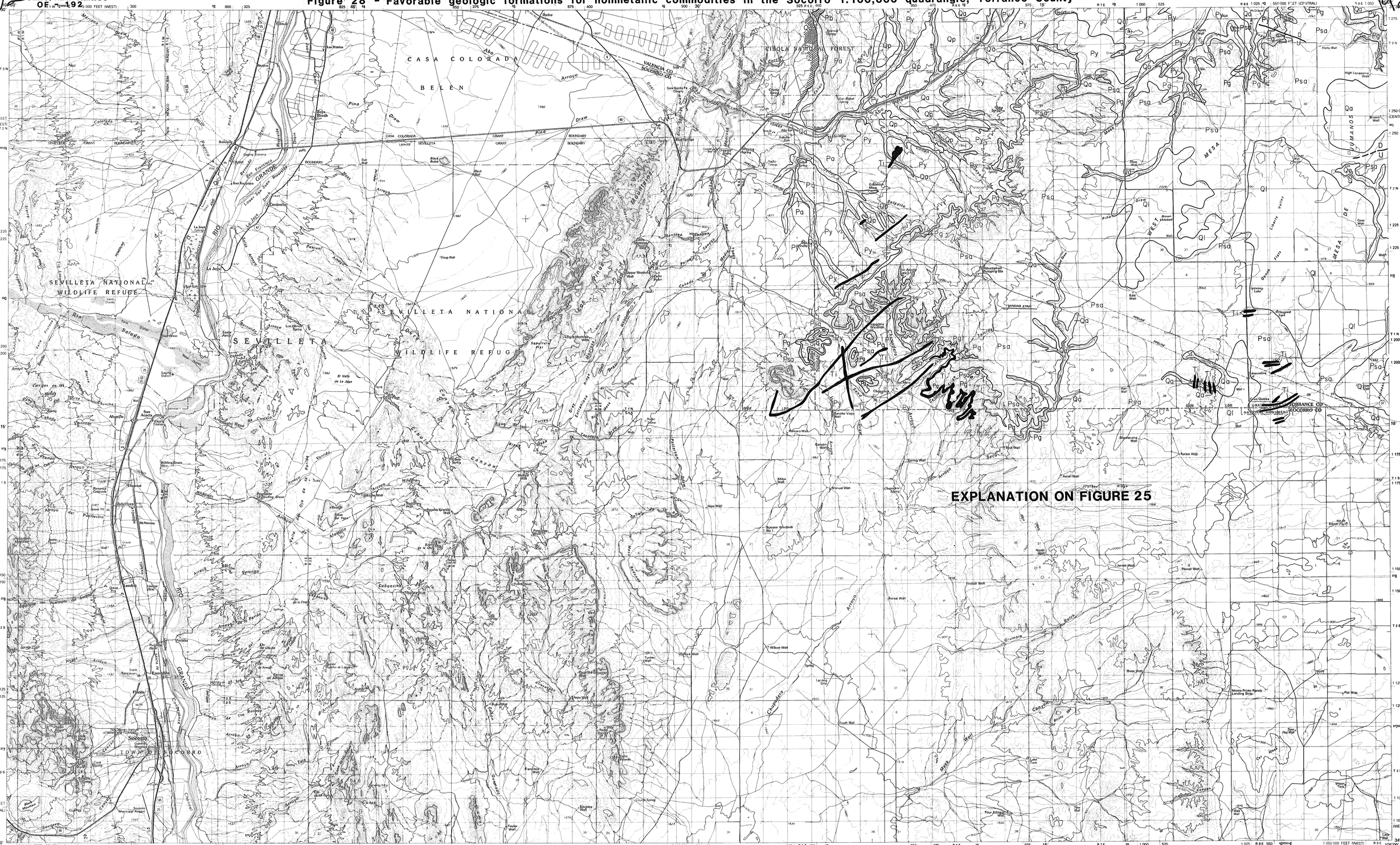

CASA COLORADO
BELEN
CIBOLA NATIONAL FOREST
SEVILLETA NATIONAL WILDLIFE REFUGE
MESA DE LOS JUMANOS
TOWN OF SOCORRO
Socorro
Rio Grande
Rio Salado
Arroyo del Parida
Arroyo Veranio
Arroyo Cañoncita
Arroyo de Tio Bartolo
Arroyo de Abeytas
Arroyo de Alamillo
Arroyo de Tajo
Arroyo de Alamosa
Arroyo de Tio Cleto
Arroyo de Amado
Arroyo de Ponce
Arroyo de Tio Lujan
Arroyo de Tio Pedro
Arroyo de Tio Tomas
Arroyo de Tio Ramon
Arroyo de Tio Jose
Arroyo de Tio Pascual

Figure 29
OF - 192
CORONA, NEW MEXICO

Figure 29 - Favorable geologic formations for nonmetallic commodities in the Corona 1:100,000 quadrangle, Torrance County

30X60 MINUTE SERIES (TOPOGRAPHIC)

192

EXPLANATION ON FIGURE 25

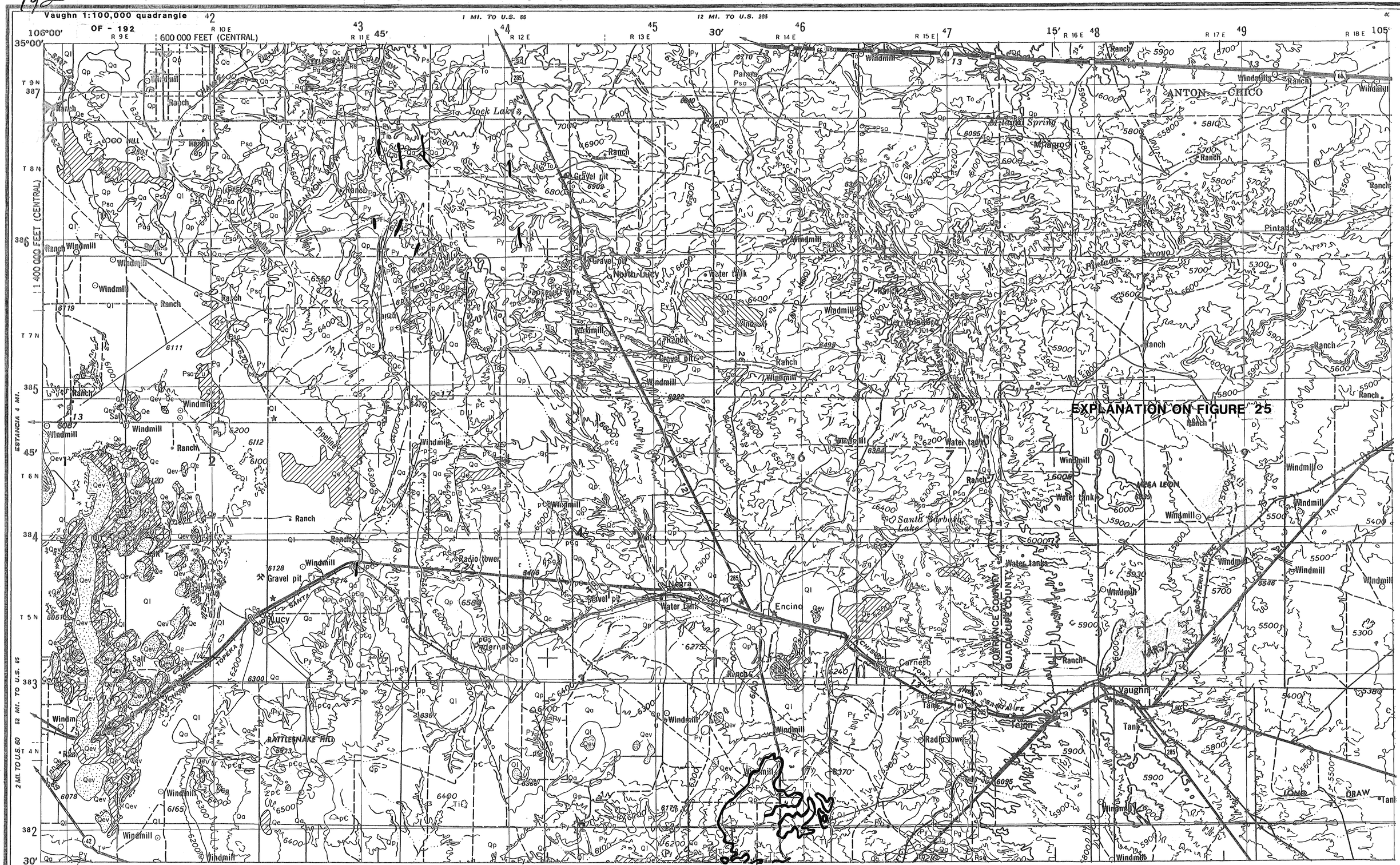
SCALE 1:100 000
1 CENTIMETER ON THE MAP REPRESENTS 1 KILOMETER ON THE GROUND
CONTOUR INTERVAL 20 METERS

CORONA, NEW MEXICO
N3400-W10500/30x60
1980

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1981

Figure 30

Figure 30 - Favorable geologic formations for nonmetallic commodities in the Vaughn 1:100,000 quadrangle



EXPLANATION ON FIGURE 25

VAUGHN 1:100,000

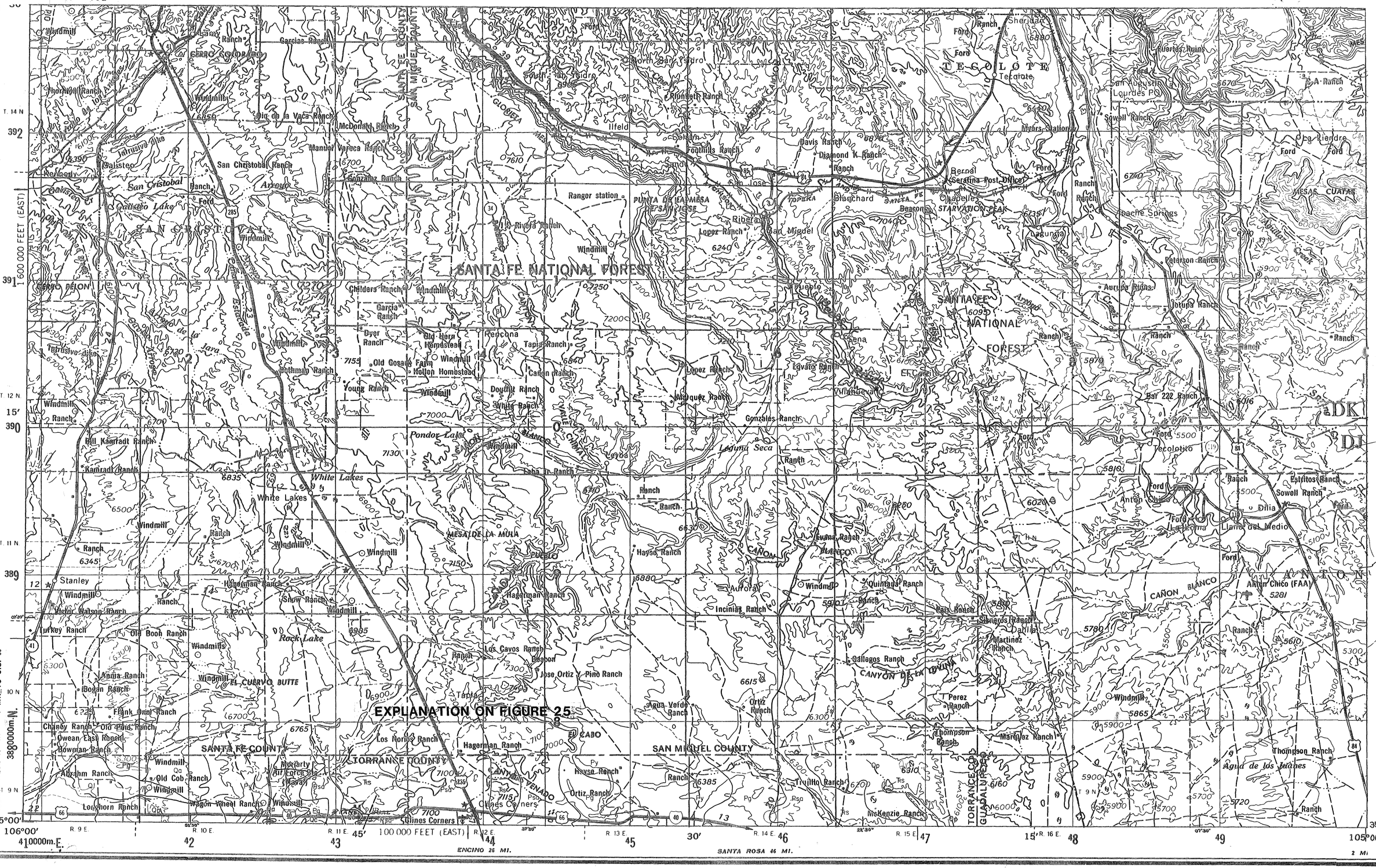
192

Figure 31

Figure 31 - Favorable geologic formations for nonmetallic commodities in the Villanueva 1:100,000 quadrangle

Villanueva 1:100,000 quadrangle

OF - 192



192

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Figure 11 - Mineral and other commodity occurrences, deposits, and mines and oil and gas tests in the Albuquerque 1:100,000 quadrangle, Torrance County

Figure 11
ALBUQUERQUE QUADRANGLE
NEW MEXICO
1:100 000-SCALE SERIES (TOPOGRAPHIC)
OF - 192


SANTO DOMINGO INDIAN RESERVATION
SANTA ANA INDIAN RESERVATION
SAN FELIPE INDIAN RESERVATION
SANDIA INDIAN RESERVATION
CANONCITO INDIAN RESERVATION
LAGUNA INDIAN RESERVATION
ALBUQUERQUE
Rio Rancho
Bernalillo
Algodones
Corrales
Alameda
Placitas
Tijeras
Cedar Crest
Sandia Park
San Antonio
Carnuel
Edgewood
Moriarty
Estancia
Mountainair
Torrance
Willard
Progress
Manzano
Gran Quivira
Duran
Chilili
Tajique
Punta
Escabosa
Meadow Lake
Juan Tabo
Sandia Crest
Sandia Peak
Tramway
Kirtland AFB
Albuquerque International Airport
Double Eagle II Airport
Coronado Monument
Petroglyph National Monument
Rio Grande
Rio Puerco
Jemez Mountains
Manzano Mountains
Sandia Mountains
Los Pinos Mountains
Ortiz Mountains
Cerrillos Hills
Hagan Basin
Estancia Basin
Galisteo Basin
Albuquerque Basin
Rio Grande Valley
Rio Puerco Valley
Tijeras Canyon
Cedro Canyon
Hell Canyon
Abo Canyon
Quarai
Abo
Gran Quivira
Salinas Pueblo Missions
Salinas Pueblo Missions Nat'l Monument
Manzano Mountains Wilderness
Cibola National Forest
Sandia Ranger District
Mountainair Ranger District
Cedro Peak
Manzano Peak
Capilla Peak
Tijeras Peak
Sandia Crest
Sandia Peak
Juan Tabo
Meadow Lake
Tijeras

Figure 12
BELEN, NEW MEXICO
OF- 192

Figure 12 - Mineral and other commodity occurrences, deposits, and mines and oil and gas tests in the Belen 1:100,000 quadrangle, Torrance County

30x60 MINUTE SERIES (TOPOGRAPHIC)

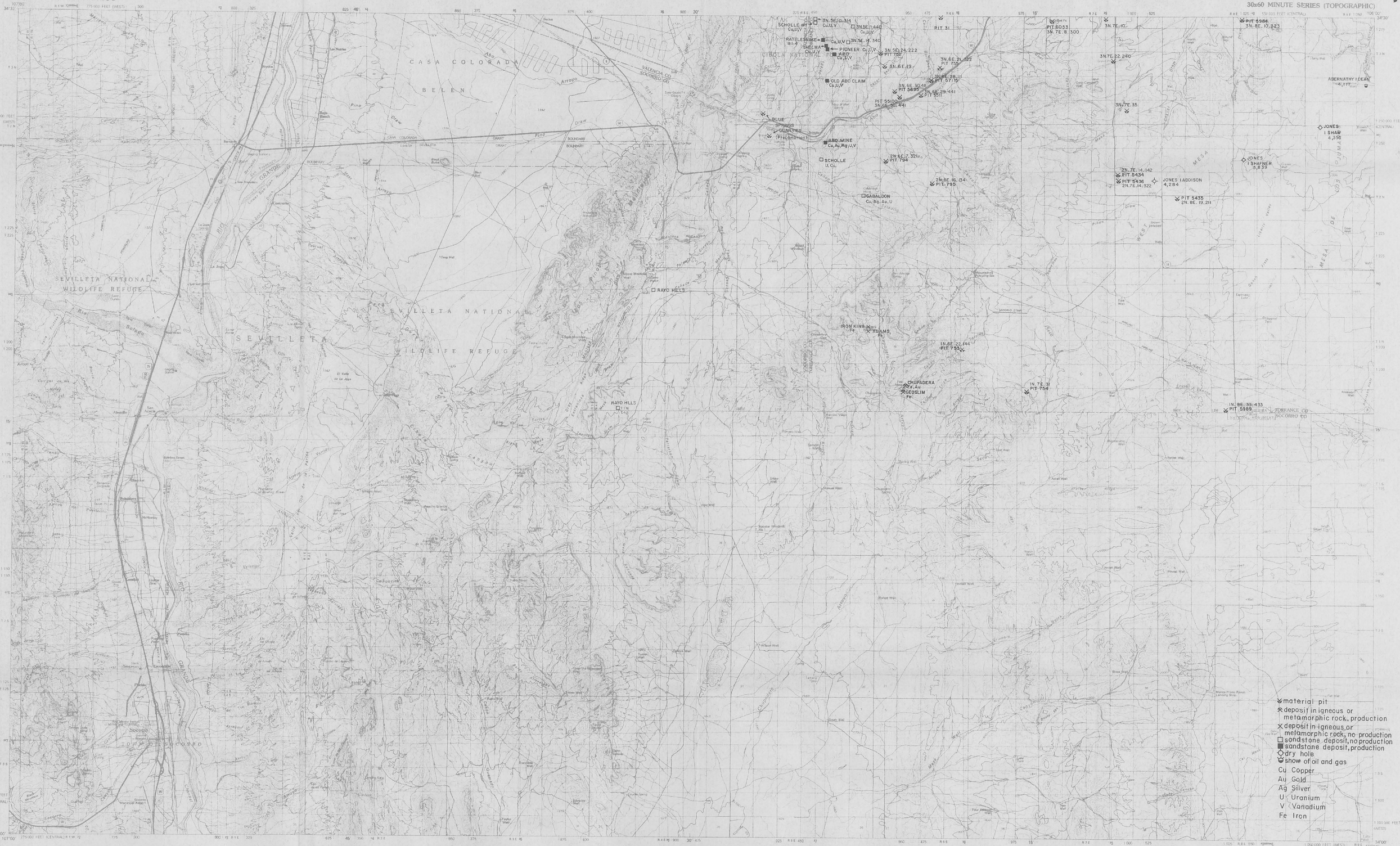
X deposit in igneous and metamorphic rock, no production
material pit
sandstone deposit, no production
dry hole
show of oil and gas
show of oil
CO_2 production
show of gas
Cu Copper
U Uranium
Ag Silver
V Vanadium
Au Gold

SCALE 1:100 000
1 CENTIMETER ON THE MAP REPRESENTS 1 KILOMETER ON THE GROUND
CONTOUR INTERVAL 50 METERS
SUPPLEMENTARY CONTOUR INTERVAL 25 METERS

BELEN, NEW MEXICO
N3430-W10600/30x60
1979

Figure 13
OF - 192
SOCORRO, NEW MEXICO

Figure 13 - Mineral and other commodity occurrences, deposits, and mines and oil and gas tests in the Socorro 1:100,000 quadrangle, Torrance County



SCALE 1:100 000
1 CENTIMETER ON THE MAP REPRESENTS 1 KILOMETER ON THE GROUND
CONTOUR INTERVAL 20 METERS

SOCORRO, NEW MEXICO
N3400 - W10600/30x60
1979

Figure 14

CORONA, NEW MEXICO
OF - 192

Figure 14 - Mineral and other commodity occurrences, deposits, and mines and oil and gas tests in the Corona 1:100,000 quadrangle, Torrance County

30X60 MINUTE SERIES (TOPOGRAPHIC)

SCALE 1:100 000
1 CENTIMETER ON THE MAP REPRESENTS 1 KILOMETER ON THE GROUND
CONTOUR INTERVAL 20 METERS

- material pit
- dry hole
- show of oil and gas
- show of oil

CORONA, NEW MEXICO
N3400-W10500/30x60
1980

Figure 15

Figure 15 - Mineral and other commodity occurrences, deposits, and mines and oil and gas tests in the Vaughn 1:100,000 quadrangle, Torrance County

Vaughn 1:100,000 quadrangle

OF - 192

600 000 FEET (CENTRAL)

1 400 000 FEET (CENTRAL)

VAUGHN 1:100,000

material pit
dry hole
show oil and gas
show of oil

Figure 16

Figure 16 - Mineral and other commodity occurrences, deposits, and mines and oil and gas tests in the Villanueva 1:100,000 quadrangle, Torrance County

Villanueva 1:100,000 quadrangle

OF - 192


VILLANUEVA 1:100,000
SANTA FE NATIONAL FOREST
SAN CRISTOBAL
TECOLOTE
SANTA FE NATIONAL FOREST
ANTON CHICO
SANTA FE COUNTY
SAN MIGUEL COUNTY
TORRANCE COUNTY
CERRO COLORADO
CERRO PELON
MESA DE LA MULA
PUNTA DE LA MESA DE SAN JOSE
EL CUERVO BUTTE
ROCK LAKE
PONDOR LAKE
LAGUNA SECA
CANON BLANCO
CANYON DE LA LIMA
CANYON VENADO
EL CABO
STARVATION PEAK
MESAS CUATAS
Ranger station
Windmill
Ranch
Ford
Beacon
Bar 222 Ranch
Villanueva
Lovato Ranch
Lopez Ranch
Gonzales Ranch
Hayse Ranch
Ortiz Ranch
Hagerman Ranch
Los Cavos Ranch
Jose Ortiz y Pino Ranch
Gallegos Ranch
Quintana Ranch
Incinias Ranch
Aurora
Agua Verde Ranch
Tapia
Tapia Ranch
Rencona
Old Hern Homestead
Old Gosark Farm
Hellen Homestead
Cañon Ranch
Doyhit Ranch
White Ranch
Young Ranch
Bothman Ranch
Garcia Ranch
Childers Ranch
Dyer Ranch
Manuel Vareca Ranch
McDonald Ranch
Gonzalez Ranch
San Christobal Ranch
Calisteo Lake
Thornton Ranch
Olio de la Vaca Ranch
Garcias Ranch
Foothills Ranch
Davis Ranch
Diamond K Ranch
Runnells Ranch
Ilfeld
Sandia
Bernal
Serafina Post Office
Chapelle
Blanchard
Myers Station
Sowell Ranch
Fuertes Ruins
C-A Ranch
Peterson Ranch
Aurora Ruins
Jorupa Ranch
Apache Springs
Peguita
Tecolote
Estritos Ranch
Dilia
Llano del Medio
Anton Chico (FAA)
5281
Thompson Ranch
Agua de los Juanes
Marquez Ranch
Perez Ranch
Martinez Ranch
Sisneros Ranch
Pais Ranch
Turkey Ranch
Old Booh Ranch
Victor Watson Ranch
Stanley
Hagerman Ranch
Snow Ranch
Annia Ranch
Bogan Ranch
Frank Owel Ranch
Chaney Ranch
Old Pino Ranch
Owean East Ranch
Bowman Ranch
Abrahm Ranch
Old Cob Ranch
Longhorn Ranch
Bill Kamradt Ranch
Kamradt Ranch
White Lakes
Mesa
Arroyo
Canada Estirada
Canada de la Jara
Intrusive dike
Cañon
Creek
Spring
Lovato Ranch
Clines Corners
Los Norios Ranch
Moriarty Air Force Sta (Navah)
Thompson Ranch
McKenzie Ranch
Trujillo Ranch
Ortiz Ranch
Ranch
Windmill
Ford
Beacon
Ribera
San Miguel
Lopez Ranch
Pueblo
Rencona
Tapia Ranch
Cañon Ranch
Doyhit Ranch
White Ranch
Young Ranch
Bothman Ranch
Garcia Ranch
Childers Ranch
Dyer Ranch
Old Hern Homestead
Old Gosark Farm
Hellen Homestead
Manuel Vareca Ranch
McDonald Ranch
Gonzalez Ranch
San Christobal Ranch
Calisteo Lake
Thornton Ranch
Olio de la Vaca Ranch
Garcias Ranch
Foothills Ranch
Davis Ranch
Diamond K Ranch
Runnells Ranch
Ilfeld

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Figure 17 - Mineral resource potential (excluding aggregate resources) of the Albuquerque 1:100,000 quadrangle

Figure 17
ALBUQUERQUE QUADRANGLE
NEW MEXICO
1:100 000-SCALE SERIES (TOPOGRAPHIC)
OF - 192


SANTA ANA INDIAN RESERVATION
SANTA ANA MESA
SAN FELIPE INDIAN RESERVATION
SANTO DOMINGO INDIAN RESERVATION
SANDIA INDIAN RESERVATION
LAGUNA INDIAN RESERVATION
CANONCITO INDIAN RESERVATION
SUBDIVISION AND PLATTED
Rio Rancho
Corrales
Bernalillo
Alameda
Placitas
Sandia Heights
Tijeras
Edgewood
Madrid
Petroleum
Ba, F, Pb, Ag veins
ALBUQUERQUE
Albuquerque International Airport
Kirtland AFB
Coronado Monument
Los Ranchos de Albuquerque
Rio Grande
Rio Puerco
Jemez Mts
Sandia Mts
Manzano Mts
Sandia Crest
Tijeras Canyon
Hell Canyon
Cedro Canyon
Bachelor Draw
Hyatt Draw
Navajo Draw
Arroyo Chamiso
Arroyo Tonque
Arroyo Galisteo
Arroyo Piedras Marcadas
Arroyo Chijuilla
Arroyo Montoya
Arroyo Boca Negra
Arroyo Jaramillo
Arroyo Seco
Arroyo Hondo
Arroyo Tejon
Arroyo Agua
Arroyo Cedro
Arroyo Cuervo
Arroyo Piedra Parada
Arroyo Tuerto
Arroyo Chamisal
Arroyo Cabezon
Arroyo Ojito
Arroyo Cañon
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Figure 18

OF - 192

BELEN, NEW MEXICO

Figure 18 - Mineral resource potential (excluding aggregate resources) of the Belen 1:100,000 quadrangle

30x60 MINUTE SERIES (TOPOGRAPHIC)


Au, massive Sulfides Precambrian greenstones
Cu, Pb, Ag, Au (+U) in Precambrian rock
Cu, Pb, Au, Ag, in Precambrian rocks
Cu, Ag, U in Abo
Cu, Ag, U in Abo
Cu, in Meseta Blanca
Cu, in Meseta Blanca
Petroleum
CO2
Halite
Petroleum
Halite
Halite
Petroleum
Petroleum
CO2
CO2
LAGUNA INDIAN RESERVATION ANTONIO SEDILLO
PAJARITO
KIRTLAND AIR FORCE BASE
CIBOLA NATIONAL FOREST
ISLETA PUEBLO
ISLETA INDIAN RESERVATION
GUTIERREZ AND SEDILLO
LO DE PADILLA
SAN CLEMENTE
NICOLAS DURAN DE CHAVEZ
TOME SUBDIVISION ROAD PATTERN
BELEN
CASA COLORADA
CHILILI
TORRANCE CO BERNALILLO CO
VALENCIA CO BERNALILLO CO
BERNALILLO CO VALENCIA CO
VALENCIA CO SOCORRO CO
TOWN OF TAJIQUE
TOWN OF TORREON
TOWN OF MANZANO
MANZANO STATE PARK
Mountainview
Pajarito
Los Padillas
Isleta
Isleta Pueblo
Chical
Pinalita
Los Lentes
Los Lunas
Valencia
Meadow Lake
Belen
Los Chavez
El Cerro
Rio Grande Estates
Jarales
Bosque
North Well
Tome
Adelino
La Constancia
Los Trujillos
Bacavillo
Pueblito
Madrone
Tuno
Vegueta
Abo
Mid Valley Airport
Municipal Airport
Estancia
Moriarty
Torreon
Tajique
Milligan
Comanche
Coyote Draw
Alamillo
Mesa Prieta
Monte Prieto
Monte Belen
Pedro
Marino Draw
Arroyo Chico
Arroyo Cuervo
Arroyo Tajique
Arroyo Torreon
Arroyo Manzano
Arroyo Chilili
Arroyo Chinchona
Arroyo Cedro
Arroyo Montano
Arroyo Milligan
Arroyo Comanche
Arroyo Coyote
Arroyo Alamillo
Arroyo Marino
Rio Puerco
Rio Grande
Rio Salado
Rio Abajo
Rio Arriba
Meseta Blanca
Manzano Mountains
Sandia Mountains
Los Pinos Mountains
Gabaldon Badlands
Laguna Indian Reservation
Pueblo Windmill
Target Reciprocal
Guthrie Reservoir
Tome Windmill
Belen Windmill
Raynolds Windmill
Barbershire Windmill
Wind Mill
Quarry
Landing Strip
Water Tank
Mountain Road
Cedro Peak
Capilla Peak
Tijeras Canyon
Hells Canyon
Chilili
Torreon
Tajique
Milligan
Comanche
Petroleum
Halite
Petroleum
Petroleum
Petroleum
Halite
Halite
Halite
Petroleum
Petroleum
Petroleum

Figure 19

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SOCORRO, NEW MEXICO

Figure 19 - Mineral resource potential (excluding aggregate resources) of the Socorro 1:100,000 quadrangle

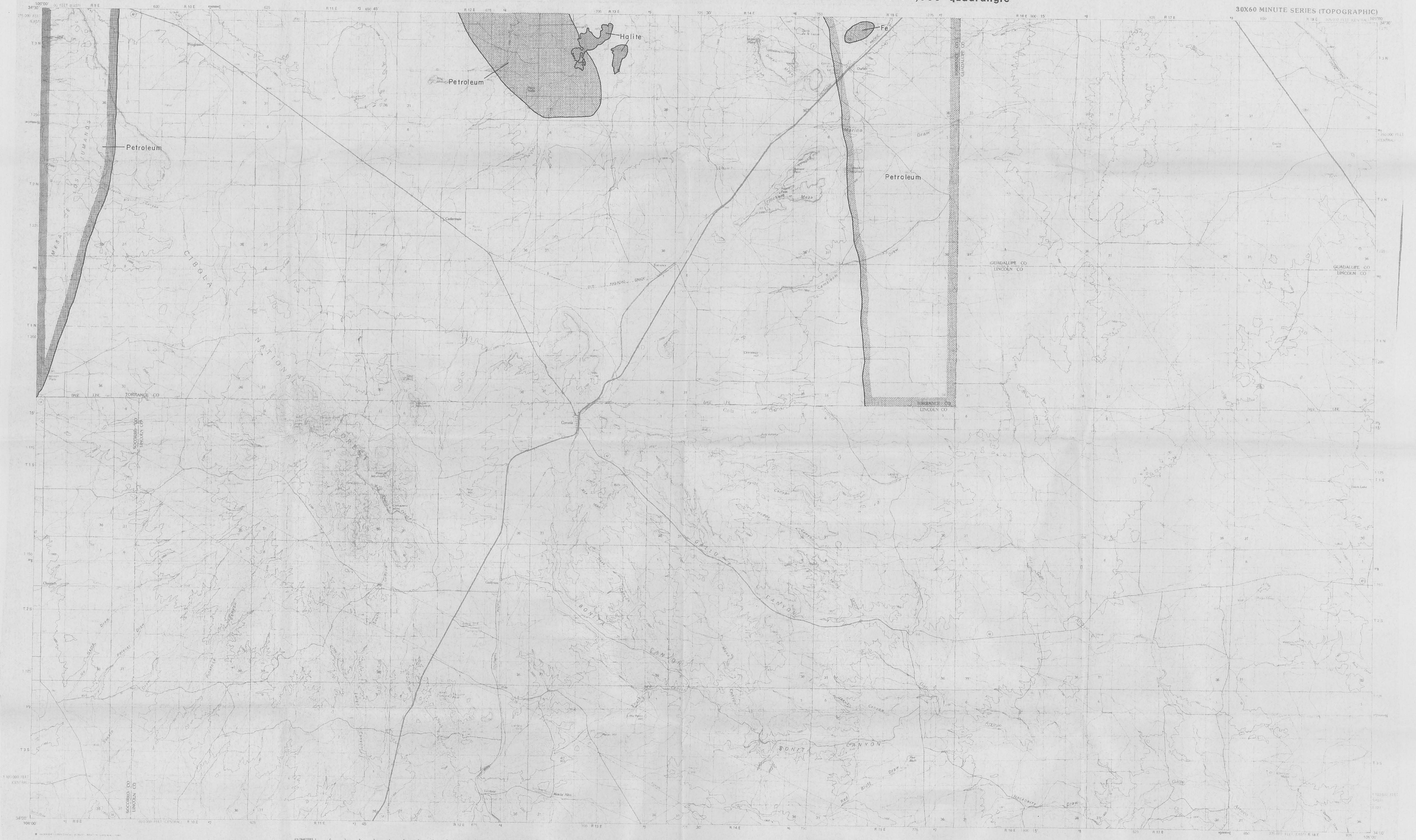


Mineral Resource Potential

- Moderate
- Low–Moderate

Figure 20
OF - 192
CORONA, NEW MEXICO

Figure 20 - Mineral resource potential (excluding aggregate resources) of the Corona 1:100,000 quadrangle



MINERAL RESOURCE POTENTIAL

Moderate

Low

Figure 21

Figure 21 - Mineral resource potential (excluding aggregate resources) of the Vaughn 1:100,000 quadrangle



VAUGHN 1:100,000

MINERAL RESOURCE POTENTIAL

- Moderate
- Low to Moderate
- Low
- Unknown

Figure 22 - Mineral resource potential (excluding aggregate resources) of the Villanueva 1:100,000 quadrangle

Villanueva 1:100,000 quadrangle

OF - 192

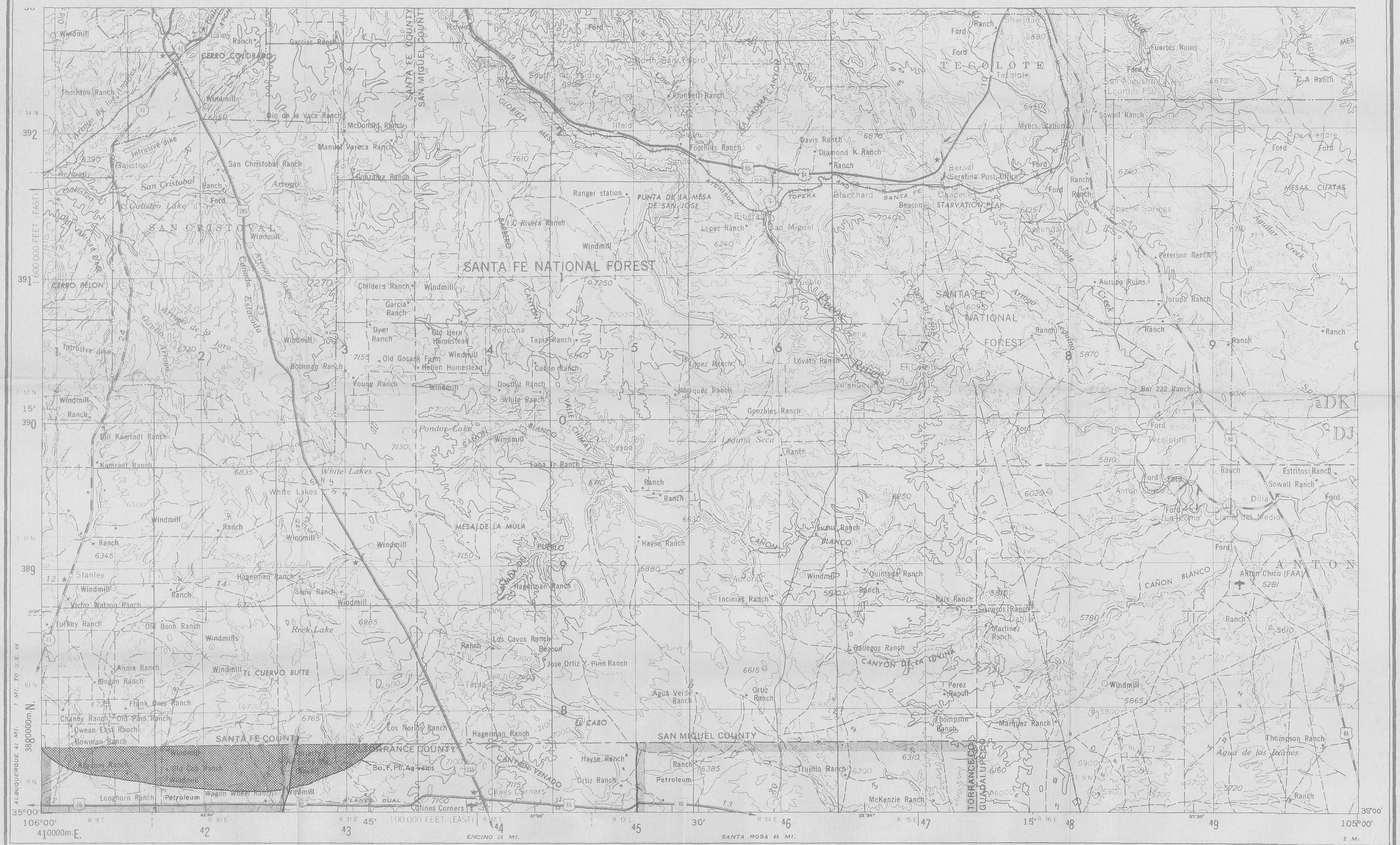

VILLANUEVA 1:100,000
SANTA FE NATIONAL FOREST
SAN CRISTOBAL
TECOLOTE
SANTA FE NATIONAL FOREST
ANTON CHICO
CERRO COLORADO
CERRO PELON
PUNTA DE LA MESA DE SAN JOSE
MESA DE LA MULA
EL CUERVO BUTTE
EL CABO
CANYON DE LA COLINA
SANTA FE COUNTY
TORRANCE COUNTY
SAN MIGUEL COUNTY
GUADALUPE
Rock Lake
Pondoro Lake
Laguna Seca
White Lakes
Gallisteo Lake
Peterson Ranch
Aurora
Petroleum
Windmill
Ranch
Ford
Arroyo
Canyon
Creek
Spring
Intrusive dike
Bar 222 Ranch
Thompson Ranch
Agua de los Juanes
Estritos Ranch
Sowell Ranch
Apache Springs
Aurora Ruins
Jorupa Ranch
Fuertes Ruins
Bill Kamradt Ranch
Kamradt Ranch
Thornton Ranch
Garcias Ranch
Dio de la Vaca Ranch
McDonald Ranch
Manuel Vareca Ranch
San Christobal Ranch
Gonzalez Ranch
Childers Ranch
Garcia Ranch
Dyer Ranch
Old Horn Homestead
Old Gosack Farm
Hellen Homestead
Bothman Ranch
Young Ranch
Tapia Ranch
Canon Ranch
Doutlu Ranch
White Ranch
Ranger station
C. Rivera Ranch
Ilfeld
Foothills Ranch
Runnels Ranch
Davis Ranch
Diamond K Ranch
Lopez Ranch
San Miguel
Ribera
Blanchard
Beacon
Bernal
Seratina Post Office
Myers Station
Lourdes PO
C-A Ranch
Mesas Cuatas
Peterson Ranch
Aurupa Ruins
Jorupa Ranch
Lovato Ranch
Villanueva
Marquez Ranch
Gonzales Ranch
Leyba
Labajr Ranch
Hayse Ranch
Eulus Ranch
Quintana Ranch
Incinias Ranch
Rais Ranch
Silveros Ranch
Martinez Ranch
Gallegos Ranch
Jose Ortiz Y Pino Ranch
Los Cavos Ranch
Agua Verde Ranch
Ortiz Ranch
Perez Ranch
Thompson Ranch
Marquez Ranch
Tijuitio Ranch
McKenzie Ranch
Los Norios Ranch
Hagerman Ranch
Show Ranch
Victor Watson Ranch
Turkey Ranch
Old Boon Ranch
Annia Ranch
Bogan Ranch
Frank Onel Ranch
Chaney Ranch
Old Pino Ranch
Owean East Ranch
Bowman Ranch
Abbott Ranch
Old Cub Ranch
Longhorn Ranch
Wagon Wheel Ranch
Stanley
Hagerman Ranch
Stines Corners
Bio, F, Pb, Ag veins
Intrusive dike
Arroyo de la Jara
Arroyo Estanda
Arroyo de los Angeles
Arroyo Gallisteo
Arroyo Jacobe
Arroyo Tecolote
Arroyo Aguilar Creek
Arroyo Lagunita
Arroyo Lagunilla
Arroyo Tecolote
Arroyo Canon
Arroyo Ranchero
Arroyo Gallisteo
Arroyo Cañon Blanco
Arroyo Cañon Venado
Arroyo Cañon de la Colina
Arroyo Cañon de la Madera

Figure 23
OF -192



Figure 23 - Aerial magnetic contour map of the Albuquerque, Socorro, Fort Sumner, and Santa Fe 1- by 2- degree quadrangles

(Prepared by Michael E. Madson, Bendix Field Engineering, Corp., 1983.)

Figure 25 – Favorable Geologic Units for Nonmetallic Commodities

Explanation for Figures 26–31

QUATERNARY

Qa Alluvium – recent alluvium or stream valley deposits of sand and gravel
POTENTIAL COMMODITIES-SAND AND GRAVEL

Qev Evaporites – evaporite deposit of salt and gypsum
POTENTIAL COMMODITIES-SALT AND GYPSUM

Qe Eolian deposits – dunes and other blow sands of quartz and gypsum
POTENTIAL COMMODITIES-SAND AND GYPSUM

Qt Terrace deposits – gravel capped benches between streams
POTENTIAL COMMODITY – GRAVEL

Ql Old Lake deposit – deposit of black to gray clay and silt from old lake beds
POTENTIAL COMMODITIES – NONE

Qp Pediment gravels – pediment surfaces underlain by caliche – cemented gravel with some sand
POTENTIAL COMMODITIES – SAND, GRAVEL AND CALICHE

Qca Caliche deposits with some sand and gravel
POTENTIAL COMMODITIES – SAND, GRAVEL, AND CALICHE

TERTIARY

Ti Intrusive dikes, sills, and stocks
POTENTIAL COMMODITIES – IRON DEPOSITS (contact-metasomatic or hydrothermal)

To Ogallala Formation – pinkish sand, gravel, silt and caliche
POTENTIAL COMMODITIES – SAND, GRAVEL AND CALICHE

TRIASSIC

Trc Chinle Formation – red mudstone, red and gray sandstone and purple limestone

Trs Santa Rosa Sandstone – red to gray, irregular bedded sandstone

PERMIAN

Pag Artesia Group Undivided – sandstone, gypsum, red mudstone and local dolomite
POTENTIAL COMMODITIES – GYPSUM

Psa San Andres Formation – light-gray to black dolomite, reddish mudstone, gypsum, and local limestone
POTENTIAL COMMODITIES – LIMESTONE, GYPSUM, DIMENSION STONE

Pg Glorieta Sandstone – light-gray to white sandstone with dolomite and limestone tongues
POTENTIAL COMMODITY – HIGH SILICA SAND

Py Yeso Formation – tan, reddish yellow, gray and white sandstone, siltstone, dolomite, gypsum, and limestone
POTENTIAL COMMODITIES – GYPSUM, LIMESTONE, BARITE – FLUORITE VEINS, STRATABOUND COPPER DEPOSITS

Pa Abo Formation – red mudstone and sandstone, minor limestones
POTENTIAL COMMODITIES – STRATABOUND COPPER DEPOSITS

PENNSYLVANIAN

Pb Bursum Formation – red brown arkose, red and gray shale and olive-gray calcarenite
POTENTIAL COMMODITY – DIMENSION STONE

IPm Madera Group Undivided – gray limestone, drak-gray calcarenite, and green shales, gray, greenish and reddish-brown sandstone with conglomerate
POTENTIAL COMMODITIES – HIGH-CA LIMESTONE, LIMESTONE

IPs Sandia Formation – dark-gray limestone, black shale, and brownish sandstone with local conglomerate

PRECAMBRIAN

p€g Precambrian granite and granite gneiss
POTENTIAL COMMODITY – DIMENSION STONE

p€ Precambrian rocks undivided
POTENTIAL COMMODITY – DIMENSION STONE

U / D Fault – dotted where concealed
U upthrown side
D downthrown side
T thrust fault

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Figure 26 - Favorable geologic formations for nonmetallic commodities in the Albuquerque 1:100,000 quadrangle, Torrance County

Figure 26
ALBUQUERQUE QUADRANGLE
NEW MEXICO
1:100 000-SCALE SERIES (TOPOGRAPHIC)
OF - 192



Mapped, edited, and published by the Geological Survey

Compiled from USGS 1:24 000 and 1:62 500-scale topographic maps dated 1954-1961. See index for dates of individual maps
Partially revised from aerial photographs taken 1975 and 1976 and from other official sources. Revised information not field checked
Map edited 1978

Projection and 10 000-meter grid, zone 13
Universal Transverse Mercator
50 000-foot grid ticks based on New Mexico coordinate system, central zone. 1927 North American datum

Areas covered by dashed light-blue pattern are subject to controlled inundation

Some grant boundaries adjacent to Rio Grande and Rio Puerco are omitted because of insufficient data

INDEX TO 1:24 000 AND 1:62 500-SCALE MAPS

1	2	3	4	5	6	7
8	9	10	11	12	13	
14	15	16	17	18	19	20
22	23	24	25	26	27	28

1 Sky Village NW - 1960
2 Sky Village NE - 1960
3 Bernalillo NW - 1960
4 Santa Ana Pueblo - 1954
5 San Felipe Pueblo - 1954
6 San Felipe Pueblo NE - 1954
7 Madrid - 1961
8 Sky Village - 1954
9 Sky Village SE - 1954 (Photorevised - 1972)
10 Sandia Mountain - 1954 (Photorevised - 1972)
11 Bernalillo - 1954 (Photorevised - 1972)
12 Tijeras - 1954
13 Hagan - 1954
14 Bernalillo Ranch - 1954
15 Valdez Ranch - 1954 (Photorevised - 1972)
16 Los Griegos - 1962 (Photorevised - 1972)
17 Alameda - 1960 (Photorevised - 1972)
18 Sandia Crest - 1961 (Photorevised - 1972)
19 Sandia Park - 1954
20 Sandia Park - 1954
21 Edgewood - 1954
22 La Mesita Negra - 1954 (Photorevised - 1972)
23 La Mesita Negra SE - 1954 (Photorevised - 1972)
24 Albuquerque West - 1960 (Photorevised - 1972)
25 Albuquerque East - 1960 (Photorevised - 1972)
26 Tijeras - 1961 (Photorevised - 1972)
27 Sedillo - 1954
28 Edgewood - 1954

UTM GRID AND 1978 MAGNETIC NORTH DECLINAN AT CENTER OF MAP

SCALE 1:100 000

KILOMETERS
MILES
FEET

CONTOUR INTERVAL 50 METERS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

NEW MEXICO
QUADRANGLE LOCATION

LEGEND

Perennial stream, lake
Intermittent stream, lake
Village or locality
Landmark structure
Public park or recreation area
Forest or game land area
Other public area or Military or Indian reservation
Built-up area

ROAD CLASSIFICATION

Primary highway, hard surface
Secondary highway, hard surface
Light-duty road, hard or improved surface
Street or unimproved road
Trail
Interstate route
U.S. route
State route

ALBUQUERQUE, NEW MEXICO
SEE ALBUQUERQUE (NI 13-7) 1:250 000 SCALE MAP

N3500—W10600/30x60

1978

This map complies with national map accuracy standards
FOR SALE BY U.S. GEOLOGICAL SURVEY DENVER, COLORADO 80225 OR RESTON, VIRGINIA 22092

Figure 27

BELEN, NEW MEXICO
OF 192

Figure 27 - Favorable geologic formations for nonmetallic commodities in the Belen 1:100,000 quadrangle, Torrance County

30x60 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION ON FIGURE 25

SCALE 1:100 000

1 CENTIMETER ON THE MAP REPRESENTS 1 KILOMETER ON THE GROUND

CONTOUR INTERVAL 50 METERS

SUPPLEMENTARY CONTOUR INTERVAL 25 METERS

BELEN, NEW MEXICO
N3430—W10600/30x60
1979

Figure 28
SOCORRO, NEW MEXICO
OF - 192

Figure 28 - Favorable geologic formations for nonmetallic commodities in the Socorro 1:100,000 quadrangle, Torrance County



Figure 29 - Favorable geologic formations for nonmetallic commodities in the Corona 1:100,000 quadrangle, Torrance County

30X60 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION ON FIGURE 25

SCALE 1:100 000
1 CENTIMETER ON THE MAP REPRESENTS 1 KILOMETER ON THE GROUND
CONTOUR INTERVAL 20 METERS

CORONA, NEW MEXICO
N3400-W10500/30x60
1980

Figure 30 - Favorable geologic formations for nonmetallic commodities in the Vaughn 1:100,000 quadrangle



VAUGHN 1:100,000

Figure 31

Villanueva 1:100,000 quadrangle

OF - 192

Figure 31 - Favorable geologic formations for nonmetallic commodities in the Villanueva 1:100,000 quadrangle

