CHARACTERIZATION OF MINERAL AND GEOTHERMAL RESOURCES IN THE EAGLE FLAT REGION, WEST TEXAS

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Prepared for the Texas Low-Level Radioactive Waste Disposal Authority

under Contract No. IAC (92-93)-0910

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September 1992

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INTRODUCTION

The location and distribution of mineral and geothermal resources of the Eagle Flat study area have been described as part of the geologic characterization of the proposed site for the Texas low-level radioactive waste repository. Mineral localities were evaluated within the 400 mi^2 (1,024 km^2) Eagle Flat study area (Allamoore, Grayton Lake, Devil Ridge, Sierra Blanca, Bean Hill, and Dome Peak 7.5-minute topographic quadrangles) surrounding the proposed site. In order to more fully evaluate the regional trends and mineralogic associations, mineral localities were also characterized within a larger 900 mi^2 (2,304 km) reconnaissance area that includes 16 additional 7.5-minute quadrangles immediately surrounding the study area.

The distribution and character of known mineral resources are important to the evaluation of the potential for economic mineral deposits on the siting area of the Texas low-level radioactive waste repository on the north Faskin Ranch. Excluding sand and gravel, which are ubiquitous in the basin, talc and possibly beryllium are the only known economic mineral deposits in the area. At the proposed site, basin-fill sediments in excess of 150 ft (45 m) thick probably preclude open-pit mining of talc or beryllium, and no favorable host rocks for talc are known to be present beneath the site. Beryllium is also highly unlikely because there are no drilling or geophysical data that indicate the occurrence of igneous intrusions beneath the basin-fill sediments of north Faskin Ranch. In addition, the site is located in a basin, not a highland, as is typical of intrusion-associated, Tertiary hydrothermal systems that occur elsewhere in the region.

Distribution and Resource Association

Over 80 known prospects, pits, quarries, abandoned or inactive mines, and active mines occur in diverse geologic settings within the study area. Appendix A lists localities by unique identification number, site name, status, commodity mined, and mineral district. The unique identification number of each locality is plotted on appendix B. An additional 141 occurrences are present in the surrounding reconnaissance area.

Mineral localities are organized into mineral associations or districts on the basis of the compilation of Price and others (1983). The groupings are referred to as districts where mining is currently active; where mining, as opposed to prospecting, occurred in the past; or where significant reserves have been delineated. Those mineral occurrences that have not had significant production are referred to as prospects. Current mineral production in both the study area and the larger reconnaissance area is limited to talc from the Allamoore talc district and aggregate (sand and gravel or crushed stone). Throughout the Trans-Pecos region, small sand and gravel quarries, crushed stone (aggregate), and borrow pits are intermittently active. Most of the mineral localities represent historic prospects that never had mineral production or were mines active prior to the early 1900's through the 1940's. Although there are many prospects and pits for base and precious metals in the study area, there is currently no active precious metals mining, and only a very small volume of precious metals ore is known to have been shipped from the study area in the past. During the 1970's and early 1980's, a dramatic rise in prices of precious metals supported a brief flurry of metals exploration near the historic mines. No new production resulted from this activity, and precious metals prices have since declined dramatically, removing the incentive for additional exploration.

In the surrounding reconnaissance area, precious and base metals mining has been widespread in the past, but mining efforts are currently inactive. Historic production from the reconnaissance area was dominated by (1) the Van Horn-Allamoore silver and copper district (Hazel, Blackshaft, and Sancho Panza mines) and (2) the Eagle Mountains fluorspar district (Spar Valley area and Eagle Springs mines). Subordinate precious and base metals production came from (1) the Northern Quitman Mountains silver, lead, and zinc district (Bonanza mine), and (2) the Van Horn Mountains silver, copper, and lead district (Plata Verde mine). Noncommercial occurrences of precious and base metals prospects are grouped by Price and others (1983) into several associations of prospects including (1) Carrizo Mountain Group prospects—copper, silver, zinc; (2) Eagle Mountains prospects—lead, zinc, silver; and (3) Eagle Flat prospects—silver and lead.

Beryllium-bearing fluorspar deposits were recognized in the early 1970's in association with intrusions in the Sierra Blanca and Round Top Mountains area. In the reconnaissance area, the Sierra Blanca fluorspar-beryllium district hosts large mineable reserves, but currently these are not being produced.

The age, rock type, and tectonic history of the outcropping strata largely control the distribution of mineral resources. Talc and other industrial minerals are associated with the metamorphosed phyllites of the Allamoore Formation. Hydrothermal activity associated with Tertiary intrusions introduced metal-rich (Ag, Cu, Pb, Zn) and fluorine-rich (fluorspar) fluids, which reacted with nearby country rock and yielded veins and replacement bodies. Such veins and replacements occur in topographic highlands associated with the Eagle, Carrizo, Van Horn, and Quitman Mountains. Price and others (1985) relate silver-copper ores that occur in veins and strata-bound deposits in Precambrian, Permian, and Cretaceous sandstones (Van Horn-Allamoore silver and copper and Van Horn Mountains silver, copper, lead districts) to low-temperature, strata-bound red-bed copper deposits. Sand and gravel deposits are typical Cenozoic bolson-fill sediments, deposited in low-lying areas and structural troughs.

Source

This compilation includes active mines, abandoned mines, prospects, and quarries whose locations were determined by literature survey. Price and others (1983) compiled mineral localities and organized them into districts that are characterized by a common mineralogic association, host rock, or mode of origin. Their compilation includes locality name, location by latitude/longitude, status of mining operation, commodity, and mineral district and is the primary basis for locality information. Additional localities were obtained from the Bureau of Economic Geology Mineral Producers Index, the Railroad Commission of Texas (Mined Lands

Inventory), and U.S. Geological Survey 7.5-minute quadrangle maps. The Railroad Commission of Texas identified and located mined lands in West Texas as a part of the Mined Lands Inventory Program. Mineral localities were cross referenced with localities from the Railroad Commission of Texas program. The Bureau of Mines' series of minerals yearbooks supplied information on production of minerals and commodities by county. Detailed geologic data from historic mines and mineral occurrences are also available in Evans (1946), King and Flawn (1953), Flawn (1958), Underwood (1963), McNulty (1974), Evans (1975), and Price (1982).

This report uses a unique BEG identification number for each locality on the basis of its location on a 7.5-minute topographic map (Texas numbering system). No information was gathered on hydrocarbon or water resources. Geothermal resources, as indicated by hot springs and water wells producing anomalously hot water, were compiled in the West Texas region by Henry (1979). Although many uranium prospects and radioactive anomalies dot the region, no commercial deposits have been recognized and no significant anomalies (greater than 100 ppm) occur within the study area or larger reconnaissance area. Anomalous (50 to 80 ppm) uranium concentrations are associated with beryllium fluorspar in the Sierra Blanca peaks.

MINING DISTRICTS AND GROUPS OF MINERAL PROSPECTS

Mining districts (historic mining activity) and groups of related prospects (no historic commercial mining) are described in the following sections, and the boundaries of the districts are mapped in figure 1. A mining district is a geographic area within which there was some historic or current mining of a single commodity or related group of commodities that occur together in a similar mode of origin or host rock. An association of prospects or localities is a geographic area that is similar to a district, but within which actual commercial mining was insignificant. The largest and most active districts are described first. Table 1 categorizes mineral districts and lists known or estimated ore and mineral production.

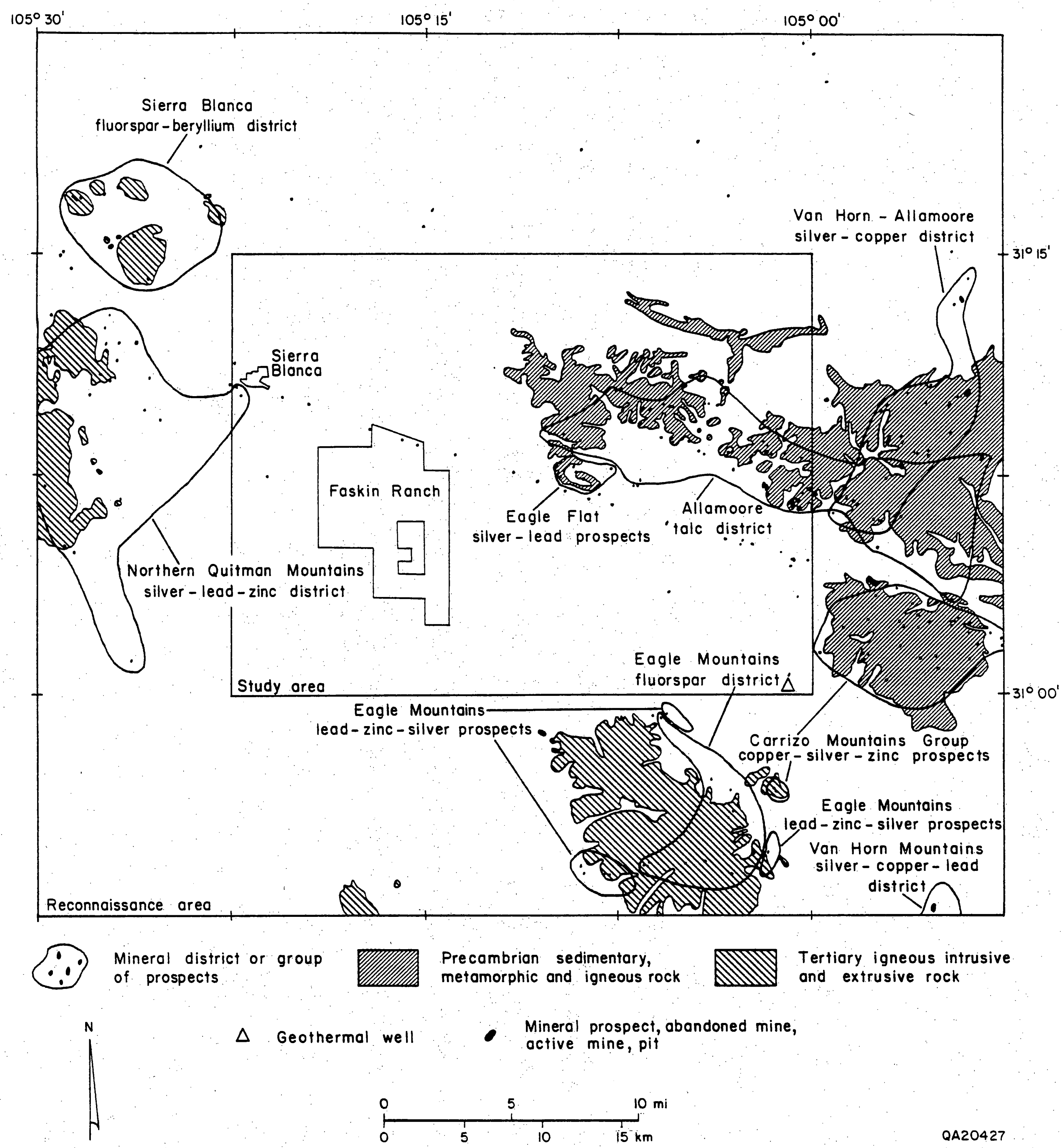

Figure 1. Map of mining districts, mineral localities, and surface outcrops of Tertiary igneous rocks and Precambrian strata in study and reconnaissance areas.

Table 1. List of mineral districts, major mines, periods of activity, and commodity mined.

DISTRICT	STATUS	HISTORY	PRODUCTION	SOURCE
Industrial Minerals				
Allamoore talc	24 active mines	1952-present	cumulative--6.2 million tons	Flawn (1958); Bureau of Mines
Sand, gravel, aggregate	many intermittent quarries	1900's-present	unknown	BEG Mineral Producers Index
Eagle Mountain fluorspar	2 mining areas: Spar Valley, Eagle Springs	production--1940's-1950's	cumulative ore--12,600 tons	McNulty (1972)
Precious and Base Metals				
Van Horn-Allamoore silver, copper	7 abandoned mines: Hazel, Blackshaft, Sancho Panza, Hackberry, St. Elmo, Mohawk, and Pecos	production--1850's-1940's; exploration--1970's-1980's	cumulative ore--133,000 tons silver--4,034,770 ozs copper--2,673,400 lbs	King and Flawn (1958); Price and others (1985); Evans (1975)
North Quitman Mountains silver, lead, zinc	3 abandoned mines (additional small mines outside reconnaissance area) Bonanza, Tarantula Hills, Bona	production--late 1800's-1920's, 1940's, 1964, 1977; exploration--1980's	cumulative ore--several thousand tons zinc--1,500,000 lbs silver, copper--no exact values	Price and others (1983)
Van Horn Mountains silver, copper, lead	1 abandoned mine Plata Verde	production--1934-1943, 1954-1955; exploration--1980's	cumulative ore--716,000 tons silver--279,213 ozs copper--123,422 lbs lead--46,189 lbs	Price (1982)

Allamoore Talc District

The Allamoore talc district began production in 1952 and since 1970 has been the sole source of talc mined in Texas. The talc is quarried from open pits. The annual production of talc from the district increased through the 1950's and 1960's. Annual production was 250,000 tons in 1990 (fig. 2) and averaged 273,000 tons since 1980 (std. dev. 48,000 tons). According to Price and others (1983) much of the talc is calcined and sold to the ceramic industry as a synthetic diopside-like product.

The Allamoore talc district extends in a belt about 5 mi (8 km) wide and 20 mi (32 km) long north of Eagle Flat in the southern foothills of the Sierra Diablo and Diablo Plateau. The long dimension of the talc district is oriented west-northwest. The talc district is coincident with the outcrop belt of the Allamoore Formation and specifically associated with phyllite. The Precambrian Allamoore Formation contains limestones, dolomites, cherts, basaltic flows and intrusions, and thin units of argillaceous rocks altered to phyllite (King and Flawn, 1953; Flawn, 1958; Barnes, 1968). Deposits range from talcose streaks to zones of talcose rocks up to 600 ft (183 m) wide and over 5,000 ft (1,524 m) long. Most deposits are steeply inclined lenticular or tabular bodies; some have been deformed into isoclinal folds with adjacent carbonate and mafic rocks (Rohrbacher, 1973). A geologic map and structure section in figure 3 illustrate the geometry and distribution of talc-replacement bodies in dolomite at the Diablo Prospect (Rohrbacher, 1973). Talc zones range up to 20 ft (6 m) thick with lengths from 3 ft (1 m) to 200 ft (60 m). The Diablo prospect also contains up to 75 percent amphibole asbestos as richterite. Rohrbacher (1973) notes the occurrence of amphibole asbestos in eight localities in the Allamoore talc district, but the Bureau of Mines reports no asbestos production.

The talcose phyllite is interpreted to have formed in the Precambrian by metamorphism or hydrothermal replacement of magnesite or dolomite that is interbedded with cherts (Flawn, 1958; Bourbon, 1981; Price and others, 1983). Relict sedimentary features and incomplete replacement of some carbonate layers clearly indicate that the talcose rocks were originally

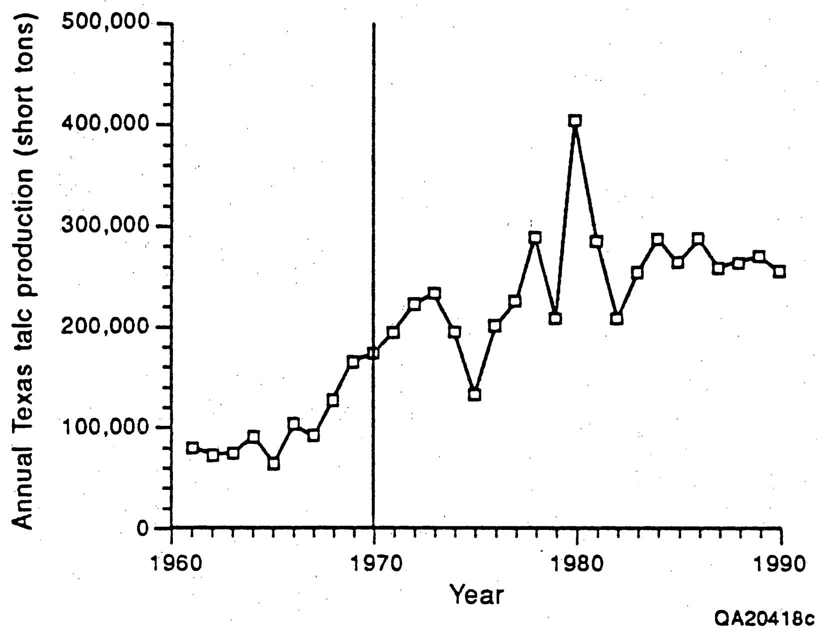

Figure 2. Graph of annual Texas talc production. Before 1970, talc was produced from the Allamoore talc district and from one small talc mine in Central Texas. After 1970, all Texas talc production came from the Allamoore talc district.

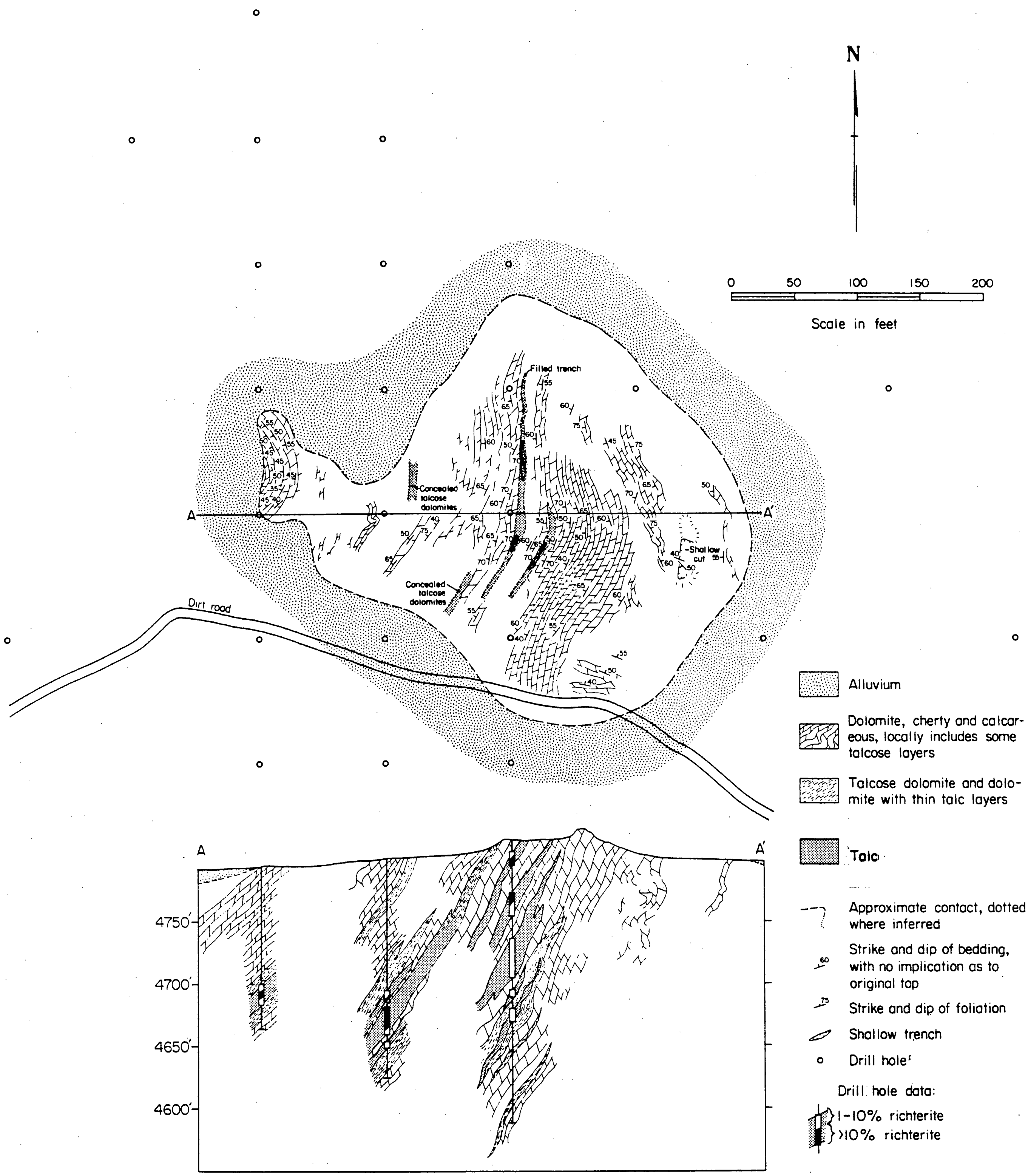

Figure 3. Geologic map and structure section of Diablo prospect (3104-223-303), Allamoore talc district. After Rohrbacher (1973).

carbonate rocks (Rohrbacher, 1973). Locally abundant quartz-dolomite pseudomorphs after halite attest to the probable evaporitic depositional environment of the magnesium-rich sedimentary host rocks that were subsequently metamorphosed. The setting and mineralogy of individual deposits are described by Edwards (1980)–Tumbledown Mountain talc deposit, King (1980)–geology of Tumbledown Mountain, and Rohrbacher (1973)–asbestos in the Allamoore talc district.

Van Horn-Allamoore Silver and Copper District

The Van Horn-Allamoore silver and copper district is characterized by two major types of copper-silver orebodies: (1) Hazel-type deposits in steeply dipping veins in sandstones of the Precambrian Hazel Formation (Hazel, Mohawk, Pecos, and Hackberry mines and the Marvin-Judson and Eureka prospects) and (2) Blackshaft-type deposits associated with lithologically diverse strata and fault gouge within the Hazel Formation that lithologically resembles the Allamoore Formation (Blackshaft, Sancho Panza, and St. Elmo mines) (King and Flawn, 1953; Evans, 1975; Price and others, 1983). Price and others (1983) slightly modified the mineral association recognized by King and Flawn (1953) for metallic sulfide minerals that occur in a number of places in the Precambrian rocks of the eastern part of the Sierra Diablo foothills. King and Flawn (1953) originally described Blackshaft-type deposits as occurring in the Allamoore Formation surrounded by the Hazel Formation and lying on a fault gouge. Price and others (1983), on the basis of a study by Reid (1974) of the Hazel Formation, recognized that the Blackshaft-type deposits actually occur in the Hazel Formation within lithologies similar to those in the Allamoore Formation.

Copper and silver, as well as some zinc and lead, have been produced from a number of mines that were intermittently active from the 1880's to 1960's. The district ranks as the largest producer of copper and the second largest producer of silver in Texas. Estimated total production from the Van Horn-Allamoore silver and copper district is 2,700,000 lb

(1,200,000 kg) of copper and 4,000,000 oz (120,000 kg) of silver (King and Flawn, 1953; Price and others, 1983). Production records from the major mines are listed in table 1. The Hazel mine has produced most of the silver and over half of the copper in the district.

Copper ores in the district averaged 2 to 3 percent. King and Flawn (1953) however, report that early mining encountered rich pockets that had up to 2,000 oz (57 kg) of silver per ton. Most of the orebodies are in narrow, steeply dipping veins that were worked by underground methods. Veins contain a diverse suite of ore minerals including tetrahedrite-tennanite, djurleite, galena, chalcopyrite, pyrite, small amounts of other ore minerals, and barite-calcite gangue.

The Hazel-type deposits are located in two structural zones: (1) a set of en echelon fractures about 3.5 mi (6.0 km) long striking easterly within the Hazel Formation (Hazel, Marvin-Judson, and Mohawk deposits) and (2) a similar set of fractures about 2 mi (3 km) long trending north-northeast that contains more lead and zinc than do the Hazel mine veins (Pecos and Eureka prospects) (King and Flawn, 1953). A generalized map and cross section of the Hazel mine (fig. 4) illustrates the geometry of the orebody and the mining levels (King and Flawn, 1953).

The Blackshaft-type deposits (Blackshaft, St. Elmo, and Sancho Panza mines) occur just north of Millican Hills. These deposits are stratabound (?) replacements of tectonically disturbed limestones, phyllites, and various igneous rocks. Small noncommercial deposits (Anaconda Nos. 1 and 2; Cooper Hill, Bluebird, and Buck Springs prospects) occur in both the Allamoore Formation and Carrizo Mountain Group in irregular, narrow veins. Davidson and others (1980) reported anomalous levels of uranium (up to 81 ppm) at the Dallas prospect.

Mineral occurrences in the Van Horn-Allamoore silver and copper district are typically (1) steeply dipping veins (Hazel-type) along faults or other zones of weakness in Precambrian Allamoore, Hazel, and Carrizo Mountain host strata or (2) stratabound deposits (Blackshaft-type) in stromatolitic dolomite, limestone, tuffaceous sandstone, shale, and chloritic fault gouge (Price and others, 1985). Weak mineralization and similar gangue minerals in veins in younger strata

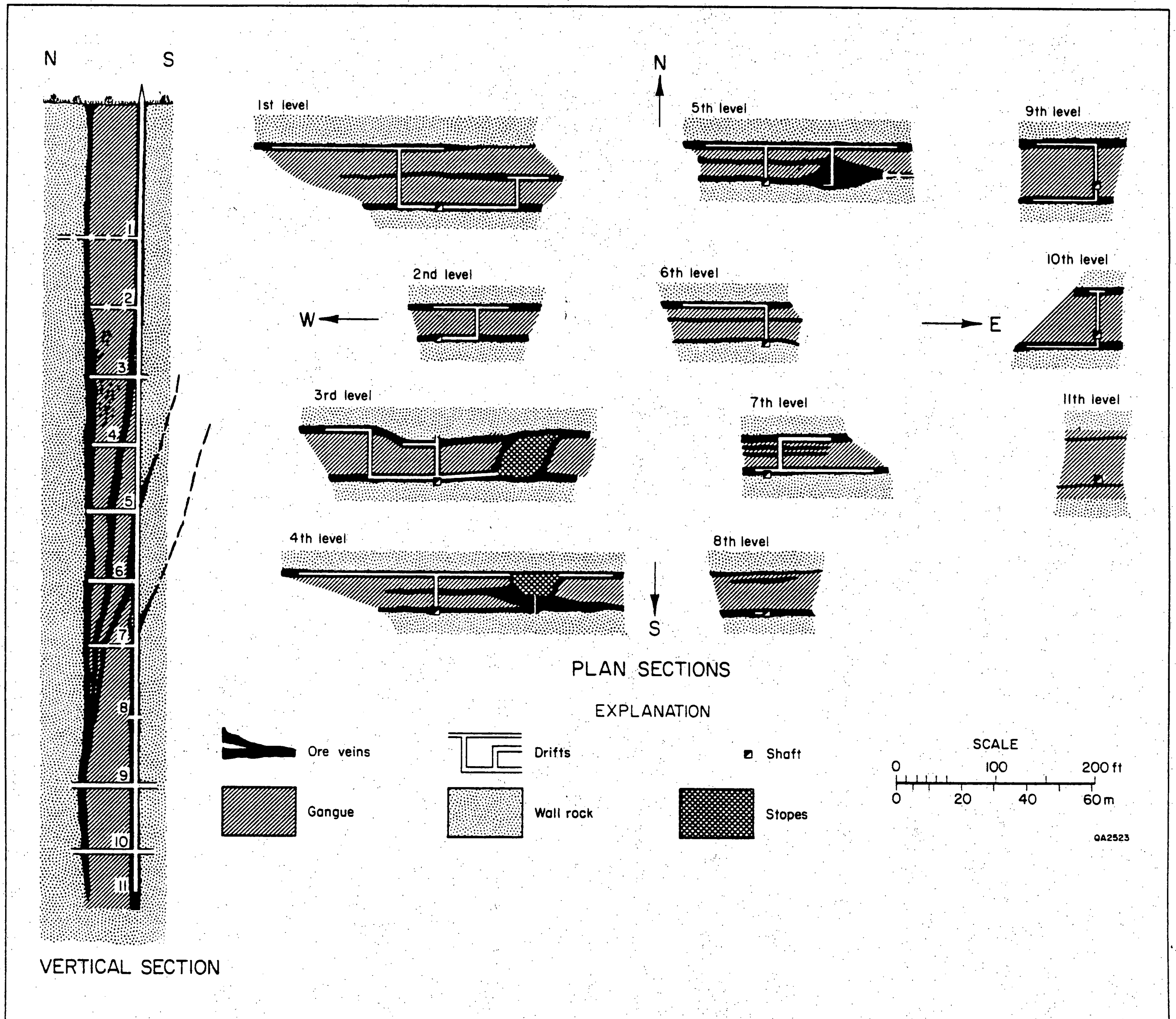

Figure 4. Vertical and plan sections, Hazel mine (3104-223-601). After Price and others (1985) from von Streeruwitz (1892).

indicate that the mineralization is younger than the host rocks. Regional considerations suggest that hydrothermal fluids emplaced the ores during Tertiary Basin and Range extensional deformation (Price and others, 1983) or during intrusive igneous activity (King and Flawn, 1953). Price and others (1983) hypothesized that most silver-copper-lead deposits in Trans-Pecos Texas, including Hazel-type deposits, Blackshaft-type deposits, and the Plata Verde mine in the Van Horn Mountains, represent red-bed type deposits that formed from moderate-temperature hydrothermal fluids that moved upward along Basin and Range fractures and precipitated minerals in response to mixing with shallow ground water.

Eagle Mountains Fluorspar District

Fluorspar mineralization is widespread over a broad area of the Eagle Mountains. Deposits include (1) replacement bodies of Cretaceous limestones and (2) veins in Tertiary rhyolitic intrusions associated with faults that cut a variety of igneous and sedimentary strata (Evans, 1946; Gillerman, 1953; Underwood, 1963; McNulty, 1974; Price and others, 1983). A modest tonnage (approximately 12,000 tons) of fluorspar was produced from replacement deposits and veins in the district. Mining activity was stimulated by high demand during World War II and mining ceased in the 1950's. Intermittent prospecting has continued since that time. McNulty (1974) reports inferred reserves of approximately 1.1 million tons of low grade (35 to 40 percent CaF_2) fluorspar in the Eagle Mountains district.

Most of the fluorspar in the Eagle Mountains district was mined in Spar Valley (11,400 of 12,000 tons) and is associated with north-northwest- (Spar Valley and Carpenter faults) and east-trending (Rhyolite and Wind Canyon faults) fault zones (McNulty, 1974). Mining has occurred in limestone replacement bodies at shaft 1 (Spar Valley), in vein fillings within rhyolite porphyries (Rhyolite vein) at shaft 2, in veins cutting Cretaceous limestones (shaft 4?), and in replacement bodies and veins in the Cretaceous Bluff Formation where a rhyolite dike has intruded along a fault striking eastward and dipping 70°S (Eagle Springs mine).

The north orebody along the Spar Valley fault is intercepted by shaft 1 and has produced the most ore. It is a bedding-replacement and void-filling deposit consisting of two or three layers of high-grade fluorspar separated by thin beds of shale (McNulty, 1974). Fluorspar occurs in brecciated zones 5 to 45 ft (2 to 14 m) thick along bedding-plane faults in the Cretaceous Finlay Limestone. The mineralized zones dip 40° to 45° to the southwest, parallel to the bedding of the host strata. A southern extension of the north orebody, termed the south orebody, is predominantly a bedding replacement with a minor amount of void filling. The principal outcrop of fluorspar is in a red siliceous limestone near the contact with the intrusive rhyolite.

The east-trending Rhyolite fault is one of several major east-trending normal faults in the Eagle Mountains associated with fluorite mineralization (McNulty, 1974). Fluorite in fault breccia occurs in zones up to 40 ft (12 m) wide and is exposed in shafts 2 and 3. At shaft 2, the workings are in rhyolite, whereas in shaft 3, fluorite-bearing breccia contains a mixture of Cretaceous and sedimentary rocks and rhyolite.

Approximately 600 tons of metallurgical-grade fluorspar was recovered from the Eagle Springs mine in the vicinity of Eagle Springs. The fluorspar occurs as both void filling and replacement deposits in fault zones cutting the Hueco Limestone (Permian) and Bluff Limestone in the Bluff Formation. The veins and replaced zones are thin and erratic (McNulty, 1974).

Hydrothermal alteration is associated with most of the deposits; argillic alteration occurs along some of the veins. The ore-forming fluids are related to the Oligocene intrusion of the Eagle Mountains intrusion and the subsequent replacement of limestone by acidic fluorine-enriched fluids. The large faults, the Rhyolite fault for instance, provided pathways for fluid migration and are the sites of most of the deposits (fig. 5). According to Price and others (1983), replacement deposits have the highest potential for additional reserves in the Eagle Mountains.

North Quitman Mountains Silver, Lead, Zinc District

The Quitman Mountains intrusion produced a complex of mineralized veins in metamorphosed Paleozoic and Mesozoic sedimentary strata. Mineralization occurs in steeply dipping quartz veins enriched in silver, galena, and sphalerite, in beryllium- and tin-bearing magnetite skarns, and in fluorite veins. In addition, some veins are enriched in tungsten, molybdenum, copper, iron, uranium, and fluorspar. The Bonanza mine is the primary source of production from the North Quitman Mountains district (Laux, 1969) and is located on the western boundary of the reconnaissance area (fig. 6). According to Price and others (1983), a

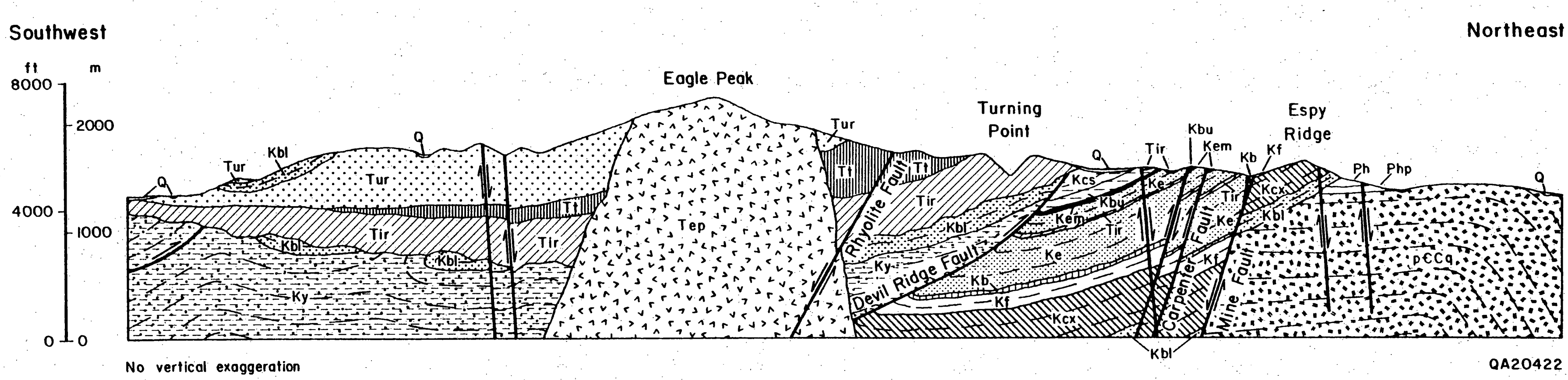

Figure 5. Cross section across Eagle Mountains and Spar Valley showing relationship of Rhyolite fault to Eagle Mountains intrusion. After Underwood (1963).

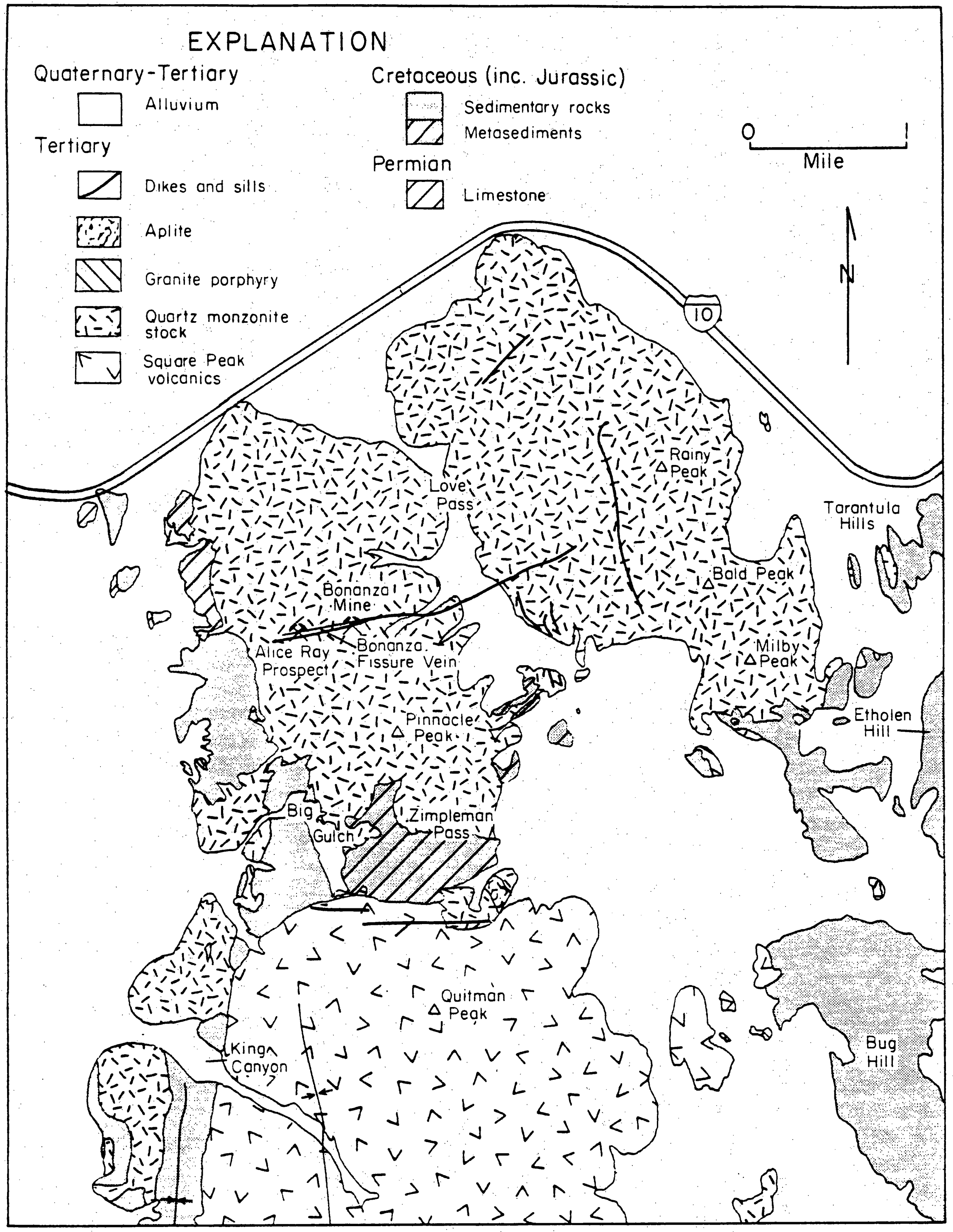

Figure 6. Geologic map of northern Quitman Mountains showing location of Bonanza mine (3105-123-401). After Evans (1975).

steeply dipping galena- and sphalerite-rich quartz vein strikes east-northeast as it cuts Oligocene quartz monzonite and follows rhyolite dikes. Evans (1975) and Price and others (1983) reported intermittent production of the Bonanza mine in pre-1900's, 1912, 1927, 1944 to 1947, 1964, and 1977 to 1979. Total production is unknown; however, McNulty (1974) estimates that several thousand tons of ore were probably produced.

The Bona prospect, located 6 mi (10 km) southwest of Sierra Blanca, is the only precious metals locality from the study area with reported production. According to Henderson and Mote (1945), Bona prospect produced 39 tons of ore in 1943 that yielded 3.5 oz gold, 43 oz silver, 2,999 lb lead, and 1,440 lb zinc.

Van Horn Mountains Silver, Copper, Lead District

Although the core of the Van Horn Mountains is outside the study and reconnaissance areas, the Plata Verde mine is located just within the southeastern boundary of the reconnaissance area (fig. 7). The Plata Verde mine is the principal ore producer in the Van Horn district and is the only occurrence of that district in the reconnaissance area. According to Price and others (1983), the Plata Verde mine was active from 1934 to 1943 (production), 1954 to 1955, and 1980 to 1983 (exploration and development). The mine produced just over 16,000 tons of ore, which yielded 279,213 oz silver, 123,422 lb copper, 48,189 lb lead, and 3.2 oz gold.

Orebodies of the Plata Verde mine are restricted to the Powwow Member of the Permian Hueco Limestone (Price, 1982) (fig. 8). Mineralized rocks are exposed in a north-trending horst that is bounded on the west by the Rim Rock fault, which is a major Basin and Range fault that has approximately 3,000 ft (910 m) of throw, and on the east by a fault with approximately 400 ft (120 m) of throw. Ore at the Plata Verde mine is enriched in silver, copper, lead, and arsenic. Most of the silver occurs in sandstones, although conglomerates, siltstones, and shales are locally mineralized. Metal-rich minerals are located dominantly along joints and small faults

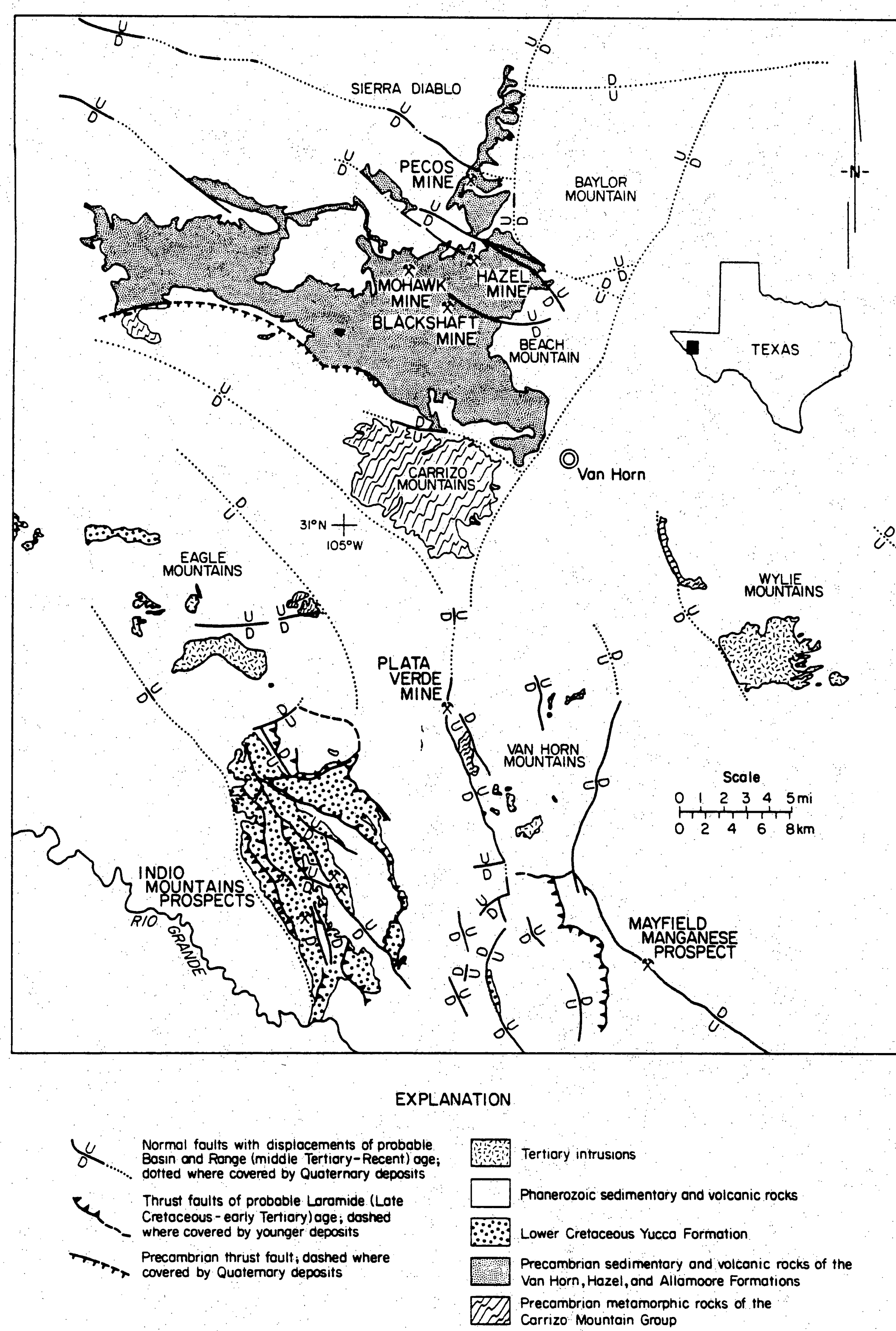

Figure 7. Geologic map showing location of Plata Verde mine (3004-333-801) and other red-bed silver mines (Blackshaft mine 3104-223-805; Hazel mine 3104-223-601; Mohawk mine 3104-223-802; and Pecos mine 3104-223-301) near Van Horn, Texas. After Price and others (1985).

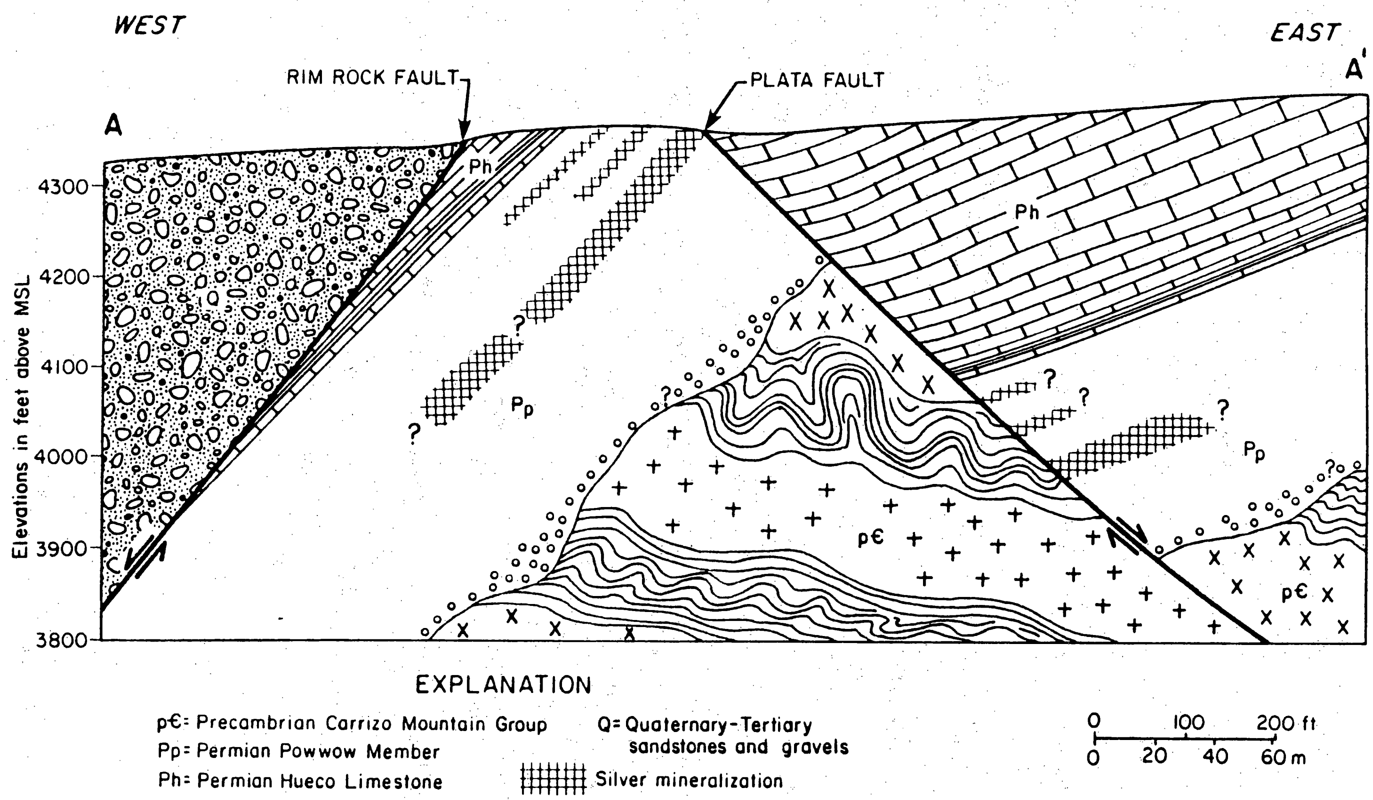

Figure 8. Generalized cross section near south shaft, Plata Verde mine (3004-333-801). After Price (1982).

and the orebody is broadly conformable with bedding. According to Price (1982), ore occurs in reduced Powwow sandstones, siltstones, and shales located directly below marine Hueco limestones and is largely conformable with bedding. Price (1982) used the above evidence and the absence of hydrothermal indicators to interpret a low-temperature "red-bed" type origin of the mineralization.

Sierra Blanca Fluorspar-Beryllium District

Sierra Blanca peaks are a series of isolated laccoliths that are located between the Quitman Mountains and Devil Ridge on the south and the southern escarpment of the Diablo Plateau. McNulty (1974) first discovered widespread fluorspar deposits replacing Cretaceous limestones, marls, and shales near or along the contact between the base of the Tertiary rhyolitic intrusion and the underlying Cretaceous rocks (fig. 9). Fluorspar deposits are a few inches to 10 ft (1 cm to 3 m) thick. Fluorspar zones up to 15 ft (5 m) thick occur along carbonate-rhyolite, shale-rhyolite, and andesite-rhyolite contacts. The fluorspar is unusually gray in color, fine grained, and enriched in beryllium, tin, uranium, and zinc. Behoite, bertrandite, and phenakite are the primary beryllium minerals; berborite and chrysoberyl are minor (Rubin and others, 1988).

Although mining has not begun, the beryllium and fluorspar deposits within the district are large enough to support a major mining operation (McNulty, 1980). Henry (1992) reports resources totaling 25 million pounds of beryllium oxide with a grade greater than 2 percent BeO.

Carrizo Mountain Group Prospects—Copper, Silver, Zinc

The Carrizo Mountain Group is exposed in the area between the Texas Pacific and Southern Pacific Railroads and along the county line between Hudspeth and Culberson Counties. In this area of sharp relief, numerous prospects dot exposures of quartz and calcite veins in a variety of metamorphic rocks, including amphibolites, metaquartzites, metaarkoses,

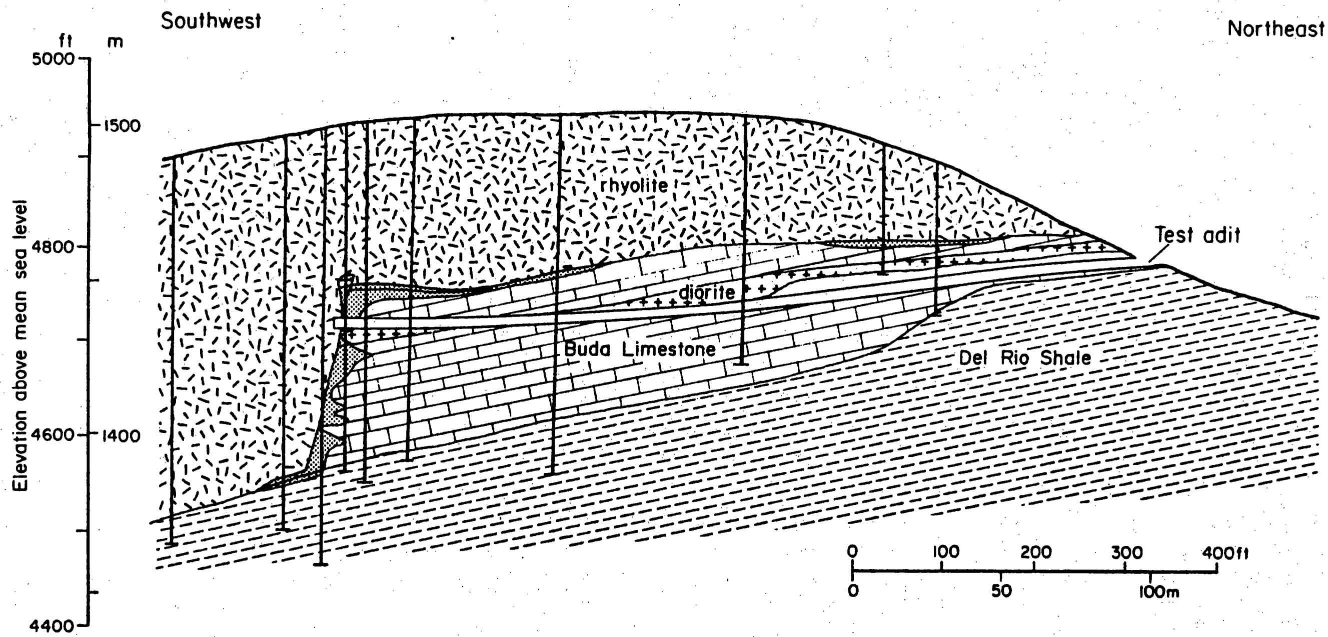

Figure 9. Generalized cross section of Round Top laccolith, Sierra Blanca fluorspar-beryllium district. After Rubin and others (1988).

phyllites, metarhyolites, and metamorphosed granodiorite (Price and others, 1983). The prospects are small, and little or no ore has been shipped (King and Flawn, 1953). According to Price and others (1983), the quartz veins formed during late Precambrian metamorphism, and thus commonly contain copper minerals, and locally lead, zinc, silver, and gold. A similar suite of copper-silver-zinc veins in deposits in the eastern Eagle Mountains is genetically similar to the Carrizo Mountain Group prospects.

Eagle Mountains Prospects—Lead, Zinc, Silver

Lead, zinc, silver, and copper mineralization occurs in small abandoned mines (Black Hills and Silver Eagle) and prospects around the northern, eastern, and southwestern periphery of the Eagle Mountains. Although exact tonnages of mined ore are unknown, cumulative historic production is inferred by Price and others (1983) to have been minor—less than 300 tons. Host rocks include hydrothermal veins in Cretaceous Bluff Formation limestone, and similar veins in a diabase dike at Snowline Canyon prospect. According to Price and others (1983), ore deposition is associated with Oligocene volcanism of the Eagle Mountains caldera.

Eagle Flat Prospects—Silver and Lead

Just north of Interstate Highway 10 at Eagle Flat, quartz veins are reported in metamorphic rocks of the Precambrian Carrizo Mountain Group and sedimentary rocks of the Permian Hueco Limestone that crop out in the southern Streeruwitz Hills. Prospectors have dug pits and several shafts looking for precious and base metals mineralization, presumably silver, lead, and gold. One of the shafts is known as the Lena mine; the amount of production, if any, is not known, however. The primary ore mineral is cerussite. The mineralization is thought by Price and others (1983) to be related to Basin and Range faulting (middle to late Tertiary).

Sand, Gravel, and Crushed Stone Quarries

Many relatively small and intermittently active quarries and borrow pits extract fill material from surficial formations in the study and reconnaissance areas. Most of the pits and quarries supply sand and gravel from unconsolidated Quaternary alluvium and terrace gravels for surfacing local roads. The widespread occurrence of the pits and the influence of roads on their distribution preclude systematic grouping of the deposits. Allamoore Quarry No. 89 (3104-222-401) is the only large quarry operation in the reconnaissance area. Precambrian rhyolite is mined and crushed for aggregate. All other sources of aggregate are for local use.

Geothermal Resources

The Trans-Pecos region of Texas contains potential geothermal resources. Numerous hot springs and wells that produce anomalously hot water occur in the Basin and Range province of Trans-Pecos Texas. This setting is similar to geothermal areas in the western United States that contain known geothermal resources (Henry, 1979).

No hot springs occur within the study area. At Hot Wells in the study area, a water well produces low-temperature (104°F [40°C]) geothermal water (Henry, 1979). Total depth of the well is 1,000 ft (305 m). The geothermal gradient in the well is 5.4°F/100 ft (75°C/km). The well is drilled in the Eagle Flat bolson, where the geothermal waters probably rose by hydrothermal convection from greater depths (Henry, 1979). However, a deep geothermal test well (2,013 ft [613 m]), the J. C. Davis No. 1, located 5 mi (8 km) southeast of Hot Wells, encountered a normal geothermal gradient of 2.9°F/100 ft (32°C/km) and a maximum temperature of 100°F (38°C).

ACKNOWLEDGMENTS

Funding for this research was provided by the Texas Low-Level Radioactive Waste Disposal Authority under Contract No. IAC (92-93)-0910. Christopher D. Henry critically reviewed the manuscript. Word processing was by Susan Lloyd. Evelynne Davis drafted the figures under the supervision of Richard L. Dillon. The manuscript was edited by Kitty Challstrom and Amanda R. Masterson. Report assembly was by Margaret L. Evans.

REFERENCES

Albritton, C. C., Jr., and Smith, J. F., Jr., 1965, Geology of the Sierra Blanca area, Hudspeth County, Texas: U.S. Geological Survey Professional Paper 479, 131 p.

Barnes, V. E., 1968, Van Horn-El Paso sheet: The University of Texas at Austin, Bureau of Economic Geology, Geologic Atlas of Texas, scale 1:250,000.

Bourbon, W. B., 1981, The origin and occurrences of talc in the Allamoore district, Culberson and Hudspeth Counties, Texas: West Texas State University, Master's thesis, 65 p.

Davidson, D. M., Jr., Edwards, G., and Goodell, P. C., 1980, Uranium assessment along the Precambrian unconformity, Van Horn area, Texas, *in* Dickerson, P. W., and Hoffer, J. M., eds., Trans-Pecos region, southeastern New Mexico and West Texas: New Mexico Geological Society 31st Field Conference Guidebook, p. 251–256.

Edwards, G., 1980, Tumbledown Mountain talc deposit, Allamoore District, Culberson County, Texas, *in* Dickerson, P. W., and Hoffer, J. M., eds., Trans-Pecos region, southeastern New Mexico and West Texas: New Mexico Geological Society 31st Field Conference Guidebook, p. 245–250.

Evans, G. L., 1946, Fluorspar in Trans-Pecos Texas, *in* Texas mineral resources: University of Texas, Austin, Bureau of Economic Geology Publication 4301, p. 105–111.

Evans, T. J., 1975, Gold and silver in Texas: The University of Texas at Austin, Bureau of Economic Geology Mineral Resource Circular No. 56, 36 p.

Flawn, P. T., 1958, Texas miners boost talc output: University of Texas, Austin, Bureau of Economic Geology Report of Investigations No. 35, 3 p. (reprinted from Engineering and Mining Journal, v. 159, p. 104–105).

Gillerman, E., 1953, Geology and fluorspar deposits of the Eagle Mountains, Trans-Pecos Texas: U.S. Geological Survey Bulletin 987, 98 p.

Henderson, C. W., and Mote, R. H., 1945, Gold, silver, copper, lead, and zinc in Texas (mine report): U.S. Bureau of Mines Minerals Yearbook, 1943, p. 457–460.

Henry, C. D., 1979, Geologic setting and geochemistry of thermal water and geothermal assessment, Trans-Pecos Texas: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 96, 48 p.

Henry, C. D., 1992, Beryllium and other rare metals in Trans-Pecos Texas: Permian Basin Section, Society of Economic Paleontologists and Mineralogists Newsletter, v. 31, no. 6, p. 15.

King, P. B., and Flawn, P. T., 1953, Geology and mineral deposits of Precambrian rocks of the Van Horn area, Texas: University of Texas, Austin, Bureau of Economic Geology Publication 5301, 218 p.

King, P. B., 1980, Geology of Tumbledown Mountain, *in* Dickerson, P. W., and Hoffer, J. M., eds., Trans-Pecos region, southeastern New Mexico and West Texas: New Mexico Geological Society 31st Field Conference Guidebook, p. 59–62.

Laux, J. P., 1969, Mineralization associated with the Quitman Mountains intrusion, Hudspeth County, Texas: The University of Texas at Austin, Master's thesis, 86 p.

McNulty, W. N., Sr., 1974, Fluorspar in Texas: The University of Texas at Austin, Bureau of Economic Geology Handbook 3, 31 p.

__________ 1980, Geology and mineralization of the Sierra Blanca Peaks, Hudspeth County, Texas, *in* Dickerson, P. W., and Hoffer, J. M., eds., Trans-Pecos region, southeastern New Mexico and West Texas: New Mexico Geological Society 31st Field Conference Guidebook, p. 263–266.

Price, J. G., 1982, Geology of the Plata Verde Mine, Hudspeth County, Texas: The University of Texas at Austin, Bureau of Economic Geology Mineral Resource Circular No. 70, 34 p.

Price, J. G., Henry, C. D., and Standen, A. R., 1983, Annotated bibliography of mineral deposits in Trans-Pecos Texas: The University of Texas at Austin, Bureau of Economic Geology Mineral Resource Circular No. 73, 108 p.

Price, J. G., Henry, C. D., Standen, A. R., and Posey, J. S., 1985, Origin of silver-copper-lead deposits in red-bed sequences of Trans-Pecos Texas: Tertiary mineralization in Precambrian, Permian, and Cretaceous sandstones: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 145, 65 p.

Reid, J. C., 1974, Hazel Formation, Culberson and Hudspeth Counties, Texas: The University of Texas at Austin, Master's thesis, 88 p.

Rohrbacher, R. C., 1973, Asbestos in the Allamoore talc district, Hudspeth and Culberson Counties, Texas: The University of Texas at Austin, Bureau of Economic Geology Geological Circular 73-1, 17 p.

Rubin, J. N., Price, J. G., Henry, C. D., Pinkston, T. L., Tweedy, S. W., Koppenaal, D. W., Peterson, S. B., Harlan, H. M., Miller, W. T., Thompson, R. J., Grabowski, R. B., Laybourn, D. P., Schrock, G. E., Johnson, A., Staes, D. G., Gaines, R. V., and Miller, F. H., 1988, Mineralogy of beryllium deposits near Sierra Blanca, Texas, *in* Torma, A. E., and Gundiler, I. H., eds., Precious and rare metal technologies: Amsterdam, Elsevier, p. 601–614.

Underwood, J. R., Jr., 1963, Geology of Eagle Mountains and vicinity, Trans-Pecos Texas: University of Texas, Austin, unpublished Ph.D. dissertation, 560 p.

von Streeruwitz, W. H., 1892, Trans-Pecos Texas: Geological survey of Texas (1891), p. 383–389.

Appendix A. Inventory of mineral occurrences, unique BEG number, locality name, location, commodity, district, and status.

BEG LOCALITY #	NAME	LATITUDE / LONGITUDE	COMMODITY	DISTRICT	TYPE
3004-333-801	Plata Verde Mine	N-30-52-38; W-104-55-18	Au, Pb, Ag	Van Horn Mts. Ag, Cu, Pb, Mn	Abandoned mine
3005-443-901	Black Hill (Dick Love Mine)	N-30-54-08; W-105-08-57	Mica	Eagle Mts. Pb, Zn, Ag, Cu	Abandoned mine
3005-443-902	Silver Eagle Mine	N-30-53-54; W-105-08-52	Pb, Ag, Zn	Eagle Mts. Pb, Zn, Ag, Cu	Abandoned mine
3005-443-903	Prospect 2	N-30-53-52; W-105-07-50	Pb	Eagle Mts. Pb, Zn, Ag, Cu	Abandoned mine
3005-443-904	Prospect 9	N-30-53-52; W-105-07-50	Ag	Eagle Mts. Pb, Zn, Ag, Cu	Abandoned mine
3005-444-101	Eagle Spring Coal Mine	N-30-59-15; W-105-06-10	Coal	Upper Cretaceous Coal Deposits	Abandoned mine
3005-444-102	Eagle Spring Fluorspar Mine	N-30-59-16; W-105-05-50	Fluorspar	Eagle Mts. Fluorspar Deposits	Abandoned mine
3005-444-103	Prospect 0, 10	N-30-59-17; W-105-05-40	Cu, Ag	Eagle Mts. Pb, Zn, Ag, Cu	Abandoned mine
3005-444-103	Unnamed prospect	N-30-59-17; W-105-05-40	Pb, Zn, Ag, Cu	Eagle Mts. Pb, Zn, Ag, Cu	Prospect
3005-444-501	Section 27 Prospect	N-30-57-11; W-105-03-49	Fluorspar	Eagle Mts. Fluorspar Deposits	Prospect
3005-444-502	Lucky Strike (Section 26) Prospect	N-30-56-47; W-105-03-10	Fluorspar	Eagle Mts. Fluorspar Deposits	Prospect
3005-444-503	Rhyolite Vein, Spar Valley	N-30-56-20; W-105-02-52	Fluorspar	Eagle Mts. Fluorspar Deposits	Abandoned mine
3005-444-504	Shaft 4, Spar Valley	N-30-56-01; W-105-03-05	Fluorspar	Eagle Mts. Fluorspar Deposits	Abandoned mine
3005-444-506	Tank Canyon Prospects	N-30-55-41; W-105-03-15	Fluorspar	Eagle Mts. Fluorspar Deposits	Prospect
3005-444-507	Syphon Canyon Prospects	N-30-55-24; W-105-02-49	Fluorspar	Eagle Mts. Fluorspar Deposits	Prospect
3005-444-601	prospect	N-30-56-42; W-105-01-28	Cu, Ag, Zn	Carrizo Mt. Cu, Ag, Zn	Abandoned mine
3005-444-602	Unnamed mine in Eagle Mts.	N-30-56-45; W-105-01-29	Cu, Ag, Zn	Carrizo Mt. Cu, Ag, Zn	Abandoned mine
3005-444-701	Fox 9 and 10 Prospects	N-30-54-10; W-105-06-21	Fluorspar	Eagle Mts. Fluorspar Deposits	Prospect
3005-444-702	Rocky Ridge Prospects	N-30-54-08; W-105-06-30	Fluorspar	Eagle Mts. Fluorspar Deposits	Prospect
3005-444-704	Section 45 Prospect	N-30-54-15; W-105-06-18	Fluorspar	Eagle Mts. Fluorspar Deposits	Prospect
3005-444-801	Ingram Prospect	N-30-54-15; W-105-03-10	Fluorspar	Eagle Mts. Fluorspar Deposits	Prospect
3005-444-802	Fox 1 and 3 Prospects	N-30-53-49; W-105-04-05	Fluorspar	Eagle Mts. Fluorspar Deposits	Prospect
3005-444-803	Divide Prospect	N-30-54-14; W-105-04-57	Fluorspar	Eagle Mts. Fluorspar Deposits	Prospect
3005-444-901	Fox 4 Prospects	N-30-54-38; W-105-02-20	Fluorspar	Eagle Mts. Fluorspar Deposits	Prospect
3005-444-902	Unnamed mine	N-30-54-36; W-105-01-48	Cu	Eagle Mts. Pb, Zn, Ag, Cu	Abandoned mine
3104-222-101	Unnamed quarry	N-31-06-50; W-104-59-56	Talc	Allamoore Talc District	Active mine
3104-222-102	Pit 3	N-31-06-40; W-104-59-05	Talc	Allamoore Talc District	Abandoned mine
3104-222-103	Cooper Hill (Rossman) Prospect	N-31-06-45; W-104-58-43	Cu, U	Van Horn-Allamoore Ag, Cu	Prospect
3104-222-104	Eagle Flat Mine	N-31-06-40; W-104-58-24	Talc	Allamoore Talc District	Active mine
3104-222-105	Bluebird Prospect	N-31-06-16; W-104-59-18	Ag	Van Horn-Allamoore Ag, Cu	Prospect
3104-222-106	Buck Spring Quarry	N-31-06-05; W-104-57-37	Talc	Allamoore Talc District	Active mine
3104-222-107	Garren II Pit	N-31-05-00; W-104-57-30	Talc	Allamoore Talc District	Active mine
3104-222-108	Unnamed prospects	N-31-06-30; W-104-58-15	Talc	Allamoore Talc District	Prospect
3104-222-201	Car Body Quarry	N-31-05-58; W-104-57-18	Talc	Allamoore Talc District	Active mine
3104-222-202	Pit 2	N-31-06-05; W-104-56-33	Talc	Allamoore Talc District	Abandoned mine
3104-222-203	Buck Springs Prospect	N-31-06-05; W-104-56-46	Ag	Van Horn-Allamoore Ag, Cu	Prospect
3104-222-204	Windmill Prospect	N-31-07-24; W-104-57-10	Talc	Allamoore Talc District	Abandoned mine
3104-222-401	Allamoore Quarry #89	N-31-03-52; W-104-57-41	Rhyolite	Aggregate	Active mine
3104-222-402	Unnamed Prospect	N-31-03-25; W-104-57-31	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-403	Sawyer Prospect	N-31-02-34; W-104-57-51	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Abandoned mine
3104-222-501	Unnamed prospect	N-31-03-42; W-104-56-43	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-502	Unnamed prospect	N-31-03-08; W-104-56-10	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-503	Unnamed prospect	N-31-02-44; W-104-55-55	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-601	Unnamed prospect	N-31-03-16; W-104-53-59	Gravel	Road metal, borrow pit	Borrow pit
3104-222-602	Neal Mann Prospect	N-31-03-21; W-104-54-46	Talc	Allamoore Talc District	Abandoned mine
3104-222-603	Unnamed prospect	N-31-02-34; W-104-54-23	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect

Appendix A (continued)

BEG LOCALITY #	NAME	LATITUDE / LONGITUDE	COMMODITY	DISTRICT	TYPE
3104-222-701	Unnamed prospect	N-31-01-25; W-104-59-45	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-702	Unnamed prospect	N-31-02-20; W-104-58-50	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-703	Unnamed prospect	N-31-01-18; W-104-58-02	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-704	Unnamed prospect	N-31-01-30; W-104-58-05	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-705	Unnamed prospect	N-31-01-22; W-104-57-55	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-801	Maltby (Knight) Prospect	N-31-02-13; W-104-55-42	Cu, Ag, Au	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-802	Unnamed prospect	N-31-02-18; W-104-56-35	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-803	Unnamed prospect	N-31-00-52; W-104-55-06	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-804	Unnamed prospect	N-31-01-13; W-104-55-53	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-805	Unnamed prospect	N-31-01-41; W-104-56-40	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-806	Unnamed prospect	N-31-00-26; W-104-57-06	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-807	Unnamed prospect	N-31-02-28; W-104-56-40	Cu-Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-808	Unnamed prospect	N-31-02-27; W-104-55-30	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-809	Unnamed prospect	N-31-01-22; W-104-55-14	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-901	Unnamed prospect	N-31-02-07; W-104-53-04	Gravel	Road metal, borrow pit	Borrow pit
3104-222-902	Unnamed prospect	N-31-01-58; W-104-52-38	Gravel	Road metal, borrow pit	Borrow pit
3104-222-903	Unnamed prospect	N-31-02-22; W-104-54-30	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-904	Unnamed prospect	N-31-02-07; W-104-53-51	Cu-Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-905	Unnamed prospect	N-31-02-18; W-104-53-26	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-906	Unnamed prospect	N-31-01-43; W-104-53-43	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-907	Unnamed prospect	N-31-02-27; W-104-54-39	Cu-Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-908	Unnamed prospect	N-31-02-27; W-104-53-56	Cu, Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-909	Unnamed prospect	N-31-01-45; W-104-52-35	Cu-Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-910	Unnamed prospect	N-31-01-17; W-104-53-56	Cu-Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-911	Unnamed prospect	N-31-02-29; W-104-54-31	Cu-Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-222-912	Unnamed prospect	N-31-02-17; W-104-53-23	Cu-Ag	Carrizo Mt. Cu, Ag, Zn	Prospect
3104-223-301	Pecos Mine	N-31-13-28; W-104-54-19	Ag, Cu, Pb, Zn	Van Horn-Allamoore Ag, Cu	Abandoned mine
3104-223-302	Eureka Prospect	N-31-14-07; W-104-53-47	Cu, Ag	Van Horn-Allamoore Ag, Cu	Prospect
3104-223-303	Diablo Prospect	N-31-13-15; W-104-54-27	Cu, Ag	Van Horn-Allamoore Ag, Cu	Prospect
3104-223-401	Unnamed prospect	N-31-10-04; W-104-59-26	Gravel	Road metal, borrow pit	Borrow pit
3104-223-501	Marvin-Judson Prospect	N-31-10-00; W-104-55-36	Cu, Ag	Van Horn-Allamoore Ag, Cu	Prospect
3104-223-502	Unnamed prospect	N-31-10-16; W-104-56-17	Cu, Ag	Van Horn-Allamoore Ag, Cu	Prospect
3104-223-503	Unnamed prospect	N-31-10-33; W-104-55-25	Cu, Ag	Van Horn-Allamoore Ag, Cu	Prospect
3104-223-601	Hazel Mine	N-31-10-13; W-104-54-00	Ag, Cu	Van Horn-Allamoore Ag, Cu	Abandoned mine
3104-223-602	Unnamed prospect	N-31-10-10; W-104-54-21	Ag, Cu	Van Horn-Allamoore Ag, Cu	Prospect
3104-223-603	Unnamed prospect	N-31-10-10; W-104-54-13	Ag, Cu	Van Horn-Allamoore Ag, Cu	Prospect
3104-223-701	Garren Ranch Quarry	N-31-07-53; W-104-57-54	Talc	Allamoore Talc District	Active mine
3104-223-702	Anaconda Number 2 Prospect	N-31-08-00; W-104-58-09	Cu	Van Horn-Allamoore Ag, Cu	Prospect
3104-223-801	Unnamed prospect	N-31-09-53; W-104-57-07	Au, Pb, Ag	Van Horn-Allamoore Ag, Cu	Prospect
3104-223-802	Mohawk Mine	N-31-09-44; W-104-57-24	Pb, Ag	Van Horn-Allamoore Ag, Cu	Abandoned mine
3104-223-803	Unnamed prospect	N-31-08-49; W-104-56-33	Au, Ag	Van Horn-Allamoore Ag, Cu	Prospect
3104-223-804	St. Elmo Mine	N-31-08-19; W-104-56-04	Cu, Ag	Van Horn-Allamoore Ag, Cu	Abandoned mine
3104-223-805	Blackshaft Mine	N-31-08-20; W-104-55-29	Cu, Ag	Van Horn-Allamoore Ag, Cu	Abandoned mine
3104-223-806	Hackberry Mine	N-31-08-09; W-104-55-28	Ag, Cu	Van Horn-Allamoore Ag, Cu	Abandoned mine
3104-223-807	Unnamed prospect	N-31-08-14; W-104-55-56	Au, Ag	Van Horn-Allamoore Ag, Cu	Prospect
3104-223-808	Sancho Panza Mine	N-31-08-39; W-104-56-23	Cu, Ag	Van Horn-Allamoore Ag, Cu	Abandoned mine

Appendix A (continued)

BEG LOCALITY #	NAME	LATITUDE / LONGITUDE	COMMODITY	DISTRICT	TYPE
3104-223-809	Lost Cow Quarry	N-31-07-46; W-104-56-34	Talc	Allamoore Talc District	Active mine
3104-223-901	Tumbledown Mountain Talc Deposit	N-31-08-05; W-104-53-22	Talc	Allamoore Talc District	Active mine
3104-223-902	Prospect 1, 8	N-31-09-52; W-104-54-35	Cu, Ag	Van Horn-Allamoore Ag, Cu	Abandoned mine
3104-223-903	Prospect 15, 16	N-31-08-50; W-104-54-37	Ag, Cu	Van Horn-Allamoore Ag, Cu	Abandoned mine
3104-232-101	Unnamed prospect	N-31-21-49; W-104-59-54	Gravel	Road metal, borrow pit	Borrow pit
3104-232-102	Unnamed prospect	N-31-20-55; W-104-59-22	Gravel	Road metal, borrow pit	Borrow pit
3104-232-901	Unnamed prospect	N-31-15-04; W-104-54-33	Gravel	Road metal, borrow pit	Borrow pit
3105-111-101	Unnamed pit	N-31-07-17; W-105-06-40	Talc	Allamoore Talc District	Prospect
3105-111-102	Unnamed pit	N-31-07-10; W-105-06-45	Road metal	Road metal, borrow pit	Borrow pit
3105-111-103	Unnamed pit	N-31-07-08; W-105-06-52	Road metal	Road metal, borrow pit	Borrow pit
3105-111-201	Unnamed pit	N-31-05-18; W-105-03-18	Road metal	Road metal, borrow pit	Borrow pit
3105-111-202	Unnamed pit	N-31-05-13; W-105-02-40	Road metal	Road metal, borrow pit	Borrow pit
3105-111-203	Unnamed pit	N-31-05-06; W-105-02-44	Road metal	Road metal, borrow pit	Borrow pit
3105-111-301	T & P #1 Quarry	N-31-07-07; W-105-01-52	Talc	Allamoore Talc District	Active mine
3105-111-302	Texola Quarry	N-31-06-47; W-105-01-40	Talc	Allamoore Talc District	Active mine
3105-111-303	Unnamed prospect	N-31-06-26; W-105-00-37	Talc	Allamoore Talc District	Prospect
3105-111-304	Unnamed prospect	N-31-06-38; W-105-00-25	Talc	Allamoore Talc District	Prospect
3105-111-305	Unnamed Quarry	N-31-06-58; W-105-00-06	Talc	Allamoore Talc District	Inactive mine
3105-111-306	Unnamed pit	N-31-06-18; W-105-00-27	Talc	Allamoore Talc District	Prospect
3105-111-307	Unnamed pit	N-31-06-50; W-105-00-19	Talc	Allamoore Talc District	Prospect
3105-111-308	Unnamed pit	N-31-05-06; W-105-02-17	Road metal	Road metal, borrow pit	Borrow pit
3105-111-401	Unnamed pit	N-31-03-31; W-105-05-30	Road metal	Road metal, borrow pit	Borrow pit
3105-111-601	Unnamed pit	N-31-04-50; W-105-01-09	Road metal	Road metal, borrow pit	Borrow pit
3105-111-602	Unnamed pit	N-31-04-35; W-105-00-53	Road metal	Road metal, borrow pit	Borrow pit
3105-111-603	Pit	N-31-04-32; W-105-00-13	Talc	Allamoore Talc District	Active mine
3105-111-604	Unnamed pit	N-31-03-19; W-105-00-31	Road metal	Road metal, borrow pit	Borrow pit
3105-111-605	Unnamed pit	N-31-04-21; W-105-00-50	Road metal	Road metal, borrow pit	Borrow pit
3105-111-901	Unnamed pit	N-31-00-39; W-105-00-54	Road metal	Road metal, borrow pit	Borrow pit
3105-112-301	Unnamed prospects near Eagle Flat	N-31-07-24; W-105-09-46	Ag, Pb, Au	Eagle Flat Prospects Ag, Pb	Prospect
3105-112-302	Lena Mine	N-31-07-16; W-105-08-48	Ag, Pb, Au	Eagle Flat Prospects Ag, Pb	Prospect
3105-112-303	Unnamed pit	N-31-06-54; W-105-09-35	Road metal	Road metal, borrow pit	Borrow pit
3105-112-304	Unnamed pit	N-31-06-39; W-105-08-41	Road metal	Road metal, borrow pit	Borrow pit
3105-112-305	Unnamed pit	N-31-06-26; W-105-07-45	Road metal	Road metal, borrow pit	Borrow pit
3105-112-306	Unnamed pit	N-31-07-14; W-105-10-39	Road metal	Road metal, borrow pit	Borrow pit
3105-112-307	Unnamed pit	N-31-06-48; W-105-08-14	Road metal	Road metal, borrow pit	Borrow pit
3105-113-601	Wilco Claims	N-31-10-19; W-105-07-34	Talc	Allamoore Talc District	Abandoned mine
3105-113-701	Unnamed pit	N-31-08-12; W-105-13-56	Road metal	Road metal, borrow pit	Borrow pit
3105-113-801	Texas Talc Quarry A (Loyce Claims)	N-31-08-51; W-105-10-00	Talc	Allamoore Talc District	Active mine
3105-113-802	Texas Talc Quarry C	N-31-08-53; W-105-10-08	Talc	Allamoore Talc District	Active mine
3105-113-803	Unnamed pit	N-31-07-32; W-105-11-35	Road metal	Road metal, borrow pit	Borrow pit
3105-113-901	Texas Talc Quarry D (Loyce Claims)	N-31-08-49; W-105-09-41	Talc	Allamoore Talc District	Active mine
3105-113-902	Texas Talc Quarry B	N-31-08-38; W-105-09-30	Talc	Allamoore Talc District	Active mine
3105-113-903	Cyprus Minerals Pit	N-31-08-38; W-105-09-01	Talc	Allamoore Talc District	Active mine
3105-113-904	Prospect 5,12	N-31-07-47; W-105-09-14	Ag, Pb	Eagle Flat Prospects Ag, Pb	Abandoned mine
3105-113-904	Unnamed prospect	N-31-07-46; W-105-09-14	Ag, Pb, Au	Eagle Flat Prospects Ag, Pb	Prospect
3105-113-905	Prospect 7,14	N-31-07-32; W-105-09-39	Ag, Pb	Eagle Flat Prospects Ag, Pb	Abandoned mine

Appendix A (continued)

BEG LOCALITY #	NAME	LATITUDE / LONGITUDE	COMMODITY	DISTRICT	TYPE
3105-113-905	Unnamed prospect	N-31-07-32; W-105-09-37	Ag, Pb, Au	Eagle Flat Prospects Ag, Pb	Prospect
3105-113-906	Prospect 6,13	N-31-07-31; W-105-09-07	Ag, Pb	Eagle Flat Prospects Ag, Pb	Abandoned mine
3105-113-906	Unnamed prospect	N-31-07-30; W-105-09-09	Ag, Pb, Au	Eagle Flat Prospects Ag, Pb	Prospect
3105-113-907	Unnamed Prospect near Lena Tank	N-31-07-42; W-105-07-46	Ag, Pb, Au	Eagle Flat Prospects Ag, Pb	Prospect
3105-114-401	Unnamed pit	N-31-10-25; W-105-07-22	Sand and gravel	Road metal, borrow pit	Borrow pit
3105-114-501	Unnamed prospect	N-31-10-16; W-105-03-21	Talc	Allamoore Talc District	Prospect
3105-114-502	Unnamed prospect	N-31-10-43; W-105-04-17	Talc	Allamoore Talc District	Prospect
3105-114-701	Bill Quarry	N-31-09-53; W-105-05-46	Talc	Allamoore Talc District	Active mine
3105-114-702	Unnamed prospect	N-31-09-48; W-105-05-22	Talc	Allamoore Talc District	Prospect
3105-114-703	Unnamed pit	N-31-09-42; W-105-06-16	Talc	Allamoore Talc District	Prospect
3105-114-704	Rex Quarry	N-31-09-45; W-105-06-31	Talc	Allamoore Talc District	Active mine
3105-114-705	Unnamed prospect	N-31-09-19; W-105-07-04	Talc	Allamoore Talc District	Prospect
3105-114-706	Buck Quarry	N-31-09-15; W-105-06-37	Talc	Allamoore Talc District	Active mine
3105-114-707	Escondido Quarry	N-31-08-44; W-105-05-27	Talc	Allamoore Talc District	Active mine
3105-114-708	Escondido Prospect	N-31-08-44; W-105-05-51	Talc	Allamoore Talc District	Prospect
3105-114-709	Unnamed pit	N-31-08-37; W-105-05-25	Sand and gravel	Road metal, borrow pit	Borrow pit
3105-114-710	Unnamed pit	N-31-09-42; W-105-07-21	Talc	Allamoore Talc District	Prospect
3105-114-801	Pit 1	N-31-08-37; W-105-04-41	Talc	Allamoore Talc District	Abandoned mine
3105-114-802	Unnamed prospect	N-31-08-17; W-105-04-22	Talc	Allamoore Talc District	Prospect
3105-114-803	Pit 4	N-31-08-13; W-105-04-15	Talc	Allamoore Talc District	Abandoned mine
3105-114-804	Dees Quarry	N-31-08-14; W-105-03-15	Talc	Allamoore Talc District	Active mine
3105-114-805	Pit 6	N-31-08-08; W-105-03-18	Talc	Allamoore Talc District	Abandoned mine
3105-114-806	Diablo Prospect, western locality	N-31-09-55; W-105-04-05	Talc	Allamoore Talc District	Prospect
3105-114-807	Diablo Prospect, eastern locality	N-31-09-57; W-105-03-50	Talc	Allamoore Talc District	Prospect
3105-114-808	Unnamed prospect	N-31-09-57; W-105-03-34	Talc	Allamoore Talc District	Prospect
3105-114-809	Unnamed pit	N-31-07-39; W-105-03-00	Talc	Allamoore Talc District	Prospect
3105-114-901	Pit 5	N-31-08-38; W-105-01-50	Talc	Allamoore Talc District	Abandoned mine
3105-114-902	Bobcat Prospect	N-31-08-29; W-105-01-41	Talc	Allamoore Talc District	Prospect
3105-114-903	Unnamed pit	N-31-08-16; W-105-01-40	Talc	Allamoore Talc District	Prospect
3105-114-904	Unnamed prospect	N-31-08-10; W-105-01-35	Talc	Allamoore Talc District	Prospect
3105-114-905	Snow White Quarry	N-31-08-11; W-105-01-01	Talc	Allamoore Talc District	Active mine
3105-114-906	Pink Chips Prospect	N-31-08-06; W-105-00-21	Talc	Allamoore Talc District	Active mine
3105-114-907	Texas Pacific RR Quarry	N-31-07-43; W-105-01-13	Talc	Allamoore Talc District	Active mine
3105-121-101	Unnamed pit	N-31-07-27; W-105-21-11	Road metal	Road metal, borrow pit	Borrow pit
3105-122-101	Quitman Gap Veins (QG-1 and 2)	N-31-05-07; W-105-28-50	Fe	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-122-102	Cowan Ranch Fluorite Locality	N-31-07-13; W-105-29-39	Fluorspar	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-122-201	Granite Hill Prospect	N-31-06-40; W-105-26-46	Be, Sn, W, No, Fe	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-122-401	Red Chief Veins	N-31-04-51; W-105-28-33	Pb, Zn	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-122-801	Unnamed prospect	N-31-01-13; W-105-26-20	Ag, Au, U	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-123-101	Unnamed pit	N-31-14-30; W-105-28-50	Sand and Gravel	Road metal, borrow pit	Borrow pit
3105-123-102	Unnamed pit	N-31-12-55; W-105-29-37	Sand and Gravel	Road metal, borrow pit	Borrow pit
3105-123-103	Unnamed pit	N-31-14-59; W-105-29-16	Sand and Gravel	Road metal, borrow pit	Borrow pit
3105-123-201	Unnamed pit	N-31-12-55; W-105-27-20	Ag	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-123-202	Sierra Blanca Occurrences (South)	N-31-14-09; W-105-25-48	Fluorspar and Beryllium	Sierra Blanca Fluorspar-Beryllium	Occurrence
3105-123-401	Bonanza Mine	N-31-11-13; W-105-30-00	Pb, Ag, Zn	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Abandoned mine
3105-123-402	Love Pass Veins	N-31-11-40; W-105-29-37	Ag	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect

Appendix A (continued)

BEG LOCALITY #	NAME	LATITUDE / LONGITUDE	COMMODITY	DISTRICT	TYPE
3105-123-403	Milby Peak Vein (MP-1)	N-31-10-57; W-105-27-41	Pb, Zn, Ag	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-123-404	Tremble Hill Prospect	N-31-10-14; W-105-28-08	Fe, Sn, Be, Cu	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-123-405	Love Pasture Prospects	N-31-10-40; W-105-29-21	Fe	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-123-406	Unnamed pit	N-31-12-29; W-105-27-32	Ag	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-123-501	Bona Prospect	N-31-11-57; W-105-26-56	Ag, Pb, Fe, Ni	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-123-502	Unnamed pit	N-31-11-57; W-105-26-16	Ag	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-123-503	Unnamed pit	N-31-10-49; W-105-25-44	Ag	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-123-504	Tarantula Hills Prospects	N-31-11-21; W-105-27-03	Pb, Ag, Zn, Au, Cu, U	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Abandoned mine
3105-123-505	Unnamed pit	N-31-10-48; W-105-27-09	Cu, Au, Ag	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-123-506	Milby Peak Vein (MP-2)	N-31-10-42; W-105-27-16	Pb, Zn, Cu	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-123-507	Stokes Prospect	N-31-11-55; W-105-27-33	Ag, Pb, U	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-123-601	Unnamed pit	N-31-10-33; W-105-22-38	Sand and gravel	Road metal, borrow pit	Borrow pit
3105-123-801	Unnamed prospect	N-31-09-21; W-105-25-21	uncertain	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-123-802	Unnamed pit	N-31-09-32; W-105-26-03	uncertain	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-124-401	Unnamed pit	N-31-11-13; W-105-22-27	Road metal	Road metal, borrow pit	Borrow pit
3105-124-402	Unnamed pit	N-31-10-06; W-105-20-35	Road metal	Road metal, borrow pit	Borrow pit
3105-124-403	Unnamed prospect near Texan Mt.	N-31-10-12; W-105-22-07	Cu	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-124-404	Unnamed pit	N-31-10-33; W-105-22-25	Cu	N. Quitman Mts. Ag, Pb, Zn, W, Sn	Prospect
3105-124-801	Unnamed pit	N-31-09-48; W-105-19-29	Road metal	Road metal, borrow pit	Borrow pit
3105-124-901	Unnamed pit	N-31-09-06; W-105-17-12	Road metal	Road metal, borrow pit	Borrow pit
3105-124-902	Unnamed pit	N-31-08-42; W-105-15-51	Road metal	Road metal, borrow pit	Borrow pit
3105-124-903	Unnamed pit	N-31-08-30; W-105-15-15	Road metal	Road metal, borrow pit	Borrow pit
3105-132-702	Round Top Prospect	N-31-16-57; W-105-28-46	Fluorspar and beryllium	Sierra Blanca fluorspar-beryllium	Abandoned mine
3105-132-703	Little Round Top Prospects	N-31-17-05; W-105-27-36	Fluorspar and beryllium	Sierra Blanca fluorspar-beryllium	Prospect
3105-132-704	Unnamed pit	N-31-15-04; W-105-28-42	Gravel	Road metal, borrow pit	Borrow pit
3105-132-801	Little Blanca Mountain Prospects	N-31-17-15; W-105-27-06	Fluorspar and beryllium	Sierra Blanca fluorspar-beryllium	Prospect
3105-132-802	Sierra Blanca Occurrences (North)	N-31-15-34; W-105-26-26	Fluorspar and beryllium	Sierra Blanca fluorspar-beryllium	Occurrence
3105-141-301	Unnamed pit	N-31-22-08; W-105-00-17	Gravel	Road metal, borrow pit	Borrow pit
3105-141-501	Unnamed pit	N-31-19-52; W-105-04-23	Gravel	Road metal, borrow pit	Borrow pit
3105-141-801	Unnamed pit	N-31-17-00; W-105-03-12	Gravel	Road metal, borrow pit	Borrow pit
3105-142-601	Unnamed pit	N-31-18-33; W-105-08-59	Sand and gravel	Road metal, borrow pit	Borrow pit
3105-142-701	Unnamed pit	N-31-16-31; W-105-14-47	Sand and gravel	Road metal, borrow pit	Borrow pit

Appendix B. Map of mineral occurrences by unique BEG number and grid of 7.5-minute quadrangles and reference number used in unique BEG locality number. The six 7.5-minute quadrangles within the study area include Sierra Blanca (3105-124), Devil Ridge (3105-121), Dome Peak (3105-113), Grayton Lake (3105-112), Bean Hills (3105-114), and Allamoore (3105-111). The 14 7.5-minute quadrangles within the reconnaissance area include Gunsight Hills South (3105-132), Pierce Ranch (3105-131), Movie Mountain (3105-142), Sneed Mountain (3105-141), Collier Mesa (3104-232), Lasca (3105-123), Sheep Peak (3104-223), Sierra Blanca SW (3105-122), Hackett Peak (3104-222), Schroder Arroyo (3005-433), Cedar Arroyo (3005-434), Eagle Mountains NW (3005-443), Bass Canyon (3004-333), and Eagle Mountains NE (3005-444).