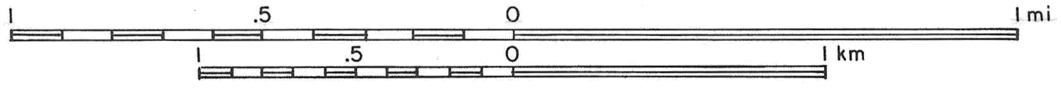
Geology of Capitol Dome quadrangle, Luna County, New Mexico

by Russell E. Clemons, 1984

scale 1:24,000



INTRODUCTION

Capitol Dome quadrangle is in east-central Luna County, immediately southeast of Deming (fig. 1). NM–11 from Deming to Columbus parallels the edge of the quadrangle 0.1 mi (0.15 km) west of the quadrangle boundary. Paved roads to Rock Hound State Park cross the northern parts of the quadrangle, and several dirt roads to cattle tanks and windmills provide access to the southern parts.

The northwest end of the Florida Mountains occupies the extreme southeast corner of the Capitol Dome quadrangle and accounts for the highest elevation (7,100 ft; 2,164 m) in the quadrangle (fig. 2). Pediment and alluvial fans extend northwest into the Mimbres Basin. The northwest half of the quadrangle with elevations between 4,220 and 4,320 ft (1,286–1,317 m) is in the western Mimbres Basin.

The Capitol Dome quadrangle was included in Darton's (1916) geologic map of Luna County and in the Deming Folio (Darton, 1917b). Lochman–Balk (1958, 1974) provided a detailed description of the Paleozoic section exposed west of Capitol Dome, and Griswold (1961) included generalized descriptions of the geology and mines in his report on the mineral deposits of Luna County. Corbitt (1971, 1974) mapped the southeast corner of the quadrangle in his reports of the Florida Mountains. Discussions on the relationships of rocks exposed in the Florida Mountains to surrounding areas are included in Bogart (1953), Brookins (1974a, 1974b, 1980), Brookins and Corbitt (1974), Brookins and others (1978), Corbitt and Woodward (1973a), Darton (1917a, 1928), Greenwood and others (1970), Hawley (1981), Hayes (1975), Hoffer, R. L., and Hoffer, J. M. (1981), Hoffer, J. M., and Hoffer, R. L. (1981), Howe (1959), Jicha (1954), Kelley and Bogart (1952), Kottlowski (1957, 1958, 1960, 1962, 1963, 1965, 1971, 1973), Kottlowski and Foster (1962), Kottlowski, Foster, and Wengerd (1969), Kottlowski, LeMone, and Foster (1969), Kottlowski and Pray (1967), LeMone (1974), Lochman–Balk (1958, 1974), Loring and Armstrong (1980), Loring and Loring (1980), Lynn (1975), Thompson (1982), Wilson and others (1969), and Woodward (1970). Structural features in the Florida Mountains and regional tectonics affecting the Florida Mountains have been discussed by Brown (1982), Brown and Clemons (1983), Corbitt and Woodward (1970, 1973b), Elston (1958), Turner (1962), Woodward (1980), and Woodward and DuChene (1981).

This report is the result of detailed geologic study conducted during 1980 and 1981 and is the second phase of a comprehensive geologic and mineral-resource investigation of the Florida Mountains. A geologic study of the Gym Peak quadrangle (phase 3) was completed in 1981–82 (Clemons and Brown, 1983), followed by a geologic study of the South Peak quadrangle (phase 4) completed in 1982 and submitted for publication in 1983. Two master's theses involving studies of the Lobo Formation by Irene S. Lemley (1982) and Mahoney mining district by Glen A. Brown (1982) were conducted as parts of phase 3.

Igneous rock names used in this report follow the IUGS classification of Streckeisen (1976, 1978).

ACKNOWLEDGMENTS—The New Mexico Bureau of Mines and Mineral Resources provided financial support for the field work and thin-section preparations. L. L. Corbitt, J. W. Hawley, G. H. Mack, W. R. Seager, and S. Thompson III are acknowledged for field discussions that aided interpretations. H. Drewes, W. R. Seager, and C. H. Thorman read the manuscript and made many suggestions for its improvement. S. W. Speer aided in examining thin sections of the Lobo Formation and assisted in the field. I am grateful to W. Greeman, R. May, and L. Horton (Deming manager for Barite of America), and all other landowners for allowing access to their lands.

STRATIGRAPHY

Precambrian rocks

Precambrian rocks crop out along the western foot of the Florida Mountains and include five map units: 1) a high-grade metamorphic sequence containing schists and gneisses, 2) hornfelses, 3) quartz syenite, 4) granite, and 5) diamictite.

METAMORPHIC SEQUENCE (*p€m*)—Two low hills on the southwest side of the mouth of Mexican Canyon are underlain by granite gneiss interlayered with biotite schist, biotite and hornblende gneisses, and amphibolite belonging to unit 1. The granite gneiss is fine to medium crystalline, strongly foliated, and contains approximately 58% potassium feldspar, 33% quartz, 7% biotite, 2% plagioclase, magnetite, and apatite. The potassium feldspar is chiefly orthoclase with kaolin and sericite alteration. One modal analysis of a fine-crystalline, dark-gray gneiss with faint foliation gave a composition of approximately 36% hornblende, 33% orthoclase, 16% quartz, 11% biotite, and 4% accessories including magnetite and apatite. The oldest rocks are probably the metamorphic rocks although their relation to the other candidate (hornfelses) is unknown, and their outcrops are separated by approximately 1 mi (1.6 km).

HORNFELSES (*p€h*)—Unit 2 contains dark-gray, fine- to medium-crystalline hornfelses that crop out around the Stenson and Copper Queen mines, in the central part of sec. 14, T. 25 S., R. 8 W. Lindgren and others (1910) described this rock as an andesite; Griswold (1961) referred to it as sheets and masses of diorite and gabbro intruded by pink and gray granite. Corbitt (1971) described the same rock as a northwest-dipping sill of diabase and gabbroic rock intrusive into syenite. Extinction angles on plagioclase, using the Michel–Levy method, indicate it has an An_{45-50} content, thus placing the rock in the diorites. The average of three modal analyses of medium-crystalline samples with ophitic texture is 52% calcic andesine, 23% uralite, 19% augite, 2% biotite, 4% magnetite, and a trace of apatite. The plagioclase has been intensely altered, chiefly to saussurite and some sericite. All of the small pyroxenes have been converted to uralite; some large pyroxene crystals are partially uralitized. The biotite is closely associated with magnetite and probably a result of deuteric alteration of the pyroxenes. The finely crystalline hornfelses contain little or no pyroxene unaltered to uralite and even more intense sericitization and saussuritization of the plagioclase than the more coarsely crystalline rocks.

Xenoliths of the hornfelses are abundant in the quartz syenite from Tubb Spring southeastward to beyond the southern edge of the Capitol Dome quadrangle. In some parts of the northwest-trending ridges between Tubb Spring and Stenson mine, outcrops are close to 50% of each rock type. Quartz syenite veins and dikelets cutting the hornfelses are seen in many exposures in the arroyos. Aplitic phases of quartz syenite are present along some of the intrusive contacts.

Brookins (1974b, 1980) reported K-Ar ages for hornblende in the (gabbro) hornfelses ranging from 530 to 555 m.y. and K-Ar ages for hornblende in the quartz syenite of 418 and 419 m.y. He also reported Rb-Sr ages on feldspars from the quartz syenite ranging from 456 to 515 m.y. Although I believe that all these ages are too young due to intense late Tertiary(?) alteration of these rocks, the chronology of the hornfelses being older than the quartz syenite agrees with field observations (Clemons, 1982c).

QUARTZ SYENITE (*p€s*)—Plutonic rock, ranging in composition from granite to quartz syenite and syenite, crops out from Tubb Spring to beyond the southern edge of the Capitol Dome quadrangle. This plutonic rock is the predominant rock type in much of the Gym Peak and South Peak quadrangles to the southeast and south, respectively. The unaltered, fresh rock is medium light gray (N6) to medium bluish gray (5B5/1), but in fresh exposures at Capitol Dome the rock varies from pink to red brown and yellowish brown as a result of hydrothermal alteration and deep chemical weathering. The texture is predominantly coarse to very coarse, with some fine- and medium-textured rocks. Locally the rock tends toward porphyritic with perthite crystals up to 2 cm long. Six modal analyses on two altered rock samples 0.5 mi (0.8 km) southeast of Tubb Spring, two fresh samples from core FM4 (Brookins and others, 1978) 3.5 mi (5.6 km) south-southeast of Tubb Spring (in South Peak quadrangle), and two fresh samples from core FM8 (Brookins and others, 1978) 3.9 mi (6.2 km) southeast of Tubb Spring (in Gym Peak quadrangle) provide the following ranges in mineral content: microcline and perthite, 58.2–93.0%; quartz, 0.2–18.2%; hastingsite, 0.8–12.2%; and biotite, trace–2.8%. One sample contains 14% augite, but not more than a trace is identified in the other samples. Accessory minerals include magnetite, apatite, zircon, and sphene.

GRANITE (*p€g*)—Precambrian granite underlies the Bliss Sandstone west and northwest of Capitol Dome in the E½ sec. 10, T. 25 S., R. 8 W. This granite intrudes the high-grade metamorphic sequence in the extreme northeast corner of sec. 10. The granite is a coarse-crystalline, reddish rock that is deeply weathered and altered. The mean of 12 thin sections from core FM5 (Brookins and others, 1978) between depths of 3 and 30 ft (1 and 9 m) have the following mineral content: 69% perthite, microcline, and minor plagioclase; 24.4% quartz; 4.3% chlorite (altered biotite); 2.1% magnetite (chiefly from altered biotite); and trace amounts of zircon, sphene, and apatite. The feldspars are intensely kaolinized, but string and patch perthite with sodic plagioclase rims can be distinguished in most samples. The quartz is typically dusted with dark inclusions and possesses slight undulose extinction and faint rhombic cleavage. Some quartz is in graphic intergrowth with microcline. The granite is cut by numerous aplite and mafic dikes of probable Precambrian age.

DIAMICTITE (*p€c*)—A small exposure of diamictite, located along the north end of the line between secs. 10 and 11, T. 25 S., R. 8 W., rests unconformably on the mafic gneisses and is overlain unconformably by Bliss Sandstone. The diamictite is 40 ft (12 m) thick and consists of from small pebble to large boulder clasts in a red and greenish fissile shale matrix (Corbitt, 1971; Corbitt and Woodward, 1973a). The clasts include 45% lithic sandstone, 17% silty hematite breccia, 17% siliceous ironstone, 12% diabase, and 10% granite. Corbitt (1971) suggested a mudflow origin, and Corbitt and Woodward (1973a) postulated a glacial origin for these beds. Evidence cited in support of a glacial origin include: 1) sedimentary structures caused by ice-rafted boulders, 2) exotic clasts, and 3) resemblance to Precambrian diamictites from Alaska to California. No conclusive evidence was found during this study.

Paleozoic rocks

BLISS SANDSTONE (*O€b*)—The Bliss Sandstone crops out intermittently for approximately 1 mi (1.6 km) along the lower slopes west and northwest of Capitol Dome. It varies in thickness from 50 to 200 ft (15–60 m) occurring as channel-fill deposits or filling depressions cut in the Precambrian granite. The Bliss Sandstone is conformably overlain by the El Paso Formation. Basal Bliss beds in the Capitol Dome area are typically arkosic, ranging from pebbly coarse- to medium-grained sandstone. Much of the quartzose sandstone above the basal units is greenish due to chlorite and mafic rock-fragment content. A red channel-fill sandstone 0.5 mi (0.8 km) west of Capitol Dome is cemented with hematite. Interbedded sandy limestone, dense gray limestone, and thin black shale and an upper white quartzite unit complete the section.

These rocks were mapped as Bliss by Darton (1916, 1917b) and Corbitt (1971). Two stratigraphic sections west of Capitol Dome were measured and described by Lochman–Balk (1958, 1974). The regional aspects of the Bliss Sandstone, including its occurrence in the Florida Mountains, were described by Flower (1953a, 1953b, 1965), Hayes (1975), Kottlowski (1963), and Thompson and Potter (1981).

EL PASO FORMATION (*Oe*)—The El Paso Formation forms an arcuate outcrop around the western slopes of Capitol Dome. It generally dips easterly, but attitudes vary locally reflecting structural deformations. Lochman–Balk (1958, 1974) described three lithic units in the El Paso Group at Capitol Dome but did not assign any formation names. The basal unit consists of 155–200 ft (47–60 m) of thin-bedded, dark-gray, medium-crystalline dolomite. The medial unit is 750 ft (229 m) of thin- to thick-bedded, light-gray to blue-gray limestone. These beds contain numerous stromatolite and sponge reefs and fossiliferous, oolitic, pelletiferous, and algal beds. The upper unit contains 115 ft (35 m) of limestone similar to the medial unit. Abundant chert lenses and elongate nodules make up as much as 25% of some of the upper-unit beds. The chert and reddish-brown-weathering aspect of these strata aid in identifying the upper unit. The upper unit is in fault contact with the middle lithic unit at Capitol Dome. Compared to complete sections of El Paso near Gym Peak, approximately 5 mi (8 km) to the southeast, the top 150 ft (45 m) of the middle unit and lower 70 ft (21 m) of the upper unit are probably not exposed at Capitol Dome due to faulting.

Darton (1916, 1917b) referred to these rocks as El Paso limestone, which had been named in the Franklin Mountains by Richardson (1904, 1909). Kelley and Silver (1952) raised the El Paso to group status, but various formations that have been named in the El Paso are not mappable at 1:24,000 scale; therefore, El Paso Formation is used in this report. The Capitol Dome section was measured and described by Lochman–Balk (1958, 1974) and remapped by Corbitt (1971). Discussions of regional correlations and depositional environments are included in Flower (1953b, 1965), Hayes (1975), Kottlowski (1963), Kottlowski, LeMone, and Foster (1969), LeMone (1969), Lucia (1969), and Lynn (1975).

MONTOYA FORMATION (*Om*)—The Montoya does not qualify as a group in southwest and south-central New Mexico, nor can it accurately be called the Montoya Dolomite, because the unit contains considerable limestone, chert, and sandstone. In this map area I am changing its status to formation. The four members that compose the Montoya Formation (basal *Cable Canyon Sandstone, Upham Dolomite, Aleman Dolomite,* and *Cutter Dolomite*) at their type localities in the Caballo Mountains (Kelley and Silver, 1952) are easily recognized in the southern Florida Mountains. The Cable Canyon Sandstone, however, is only represented by basal sandy beds of the Upham Dolomite. None are thick enough to be shown at the scale of this map.

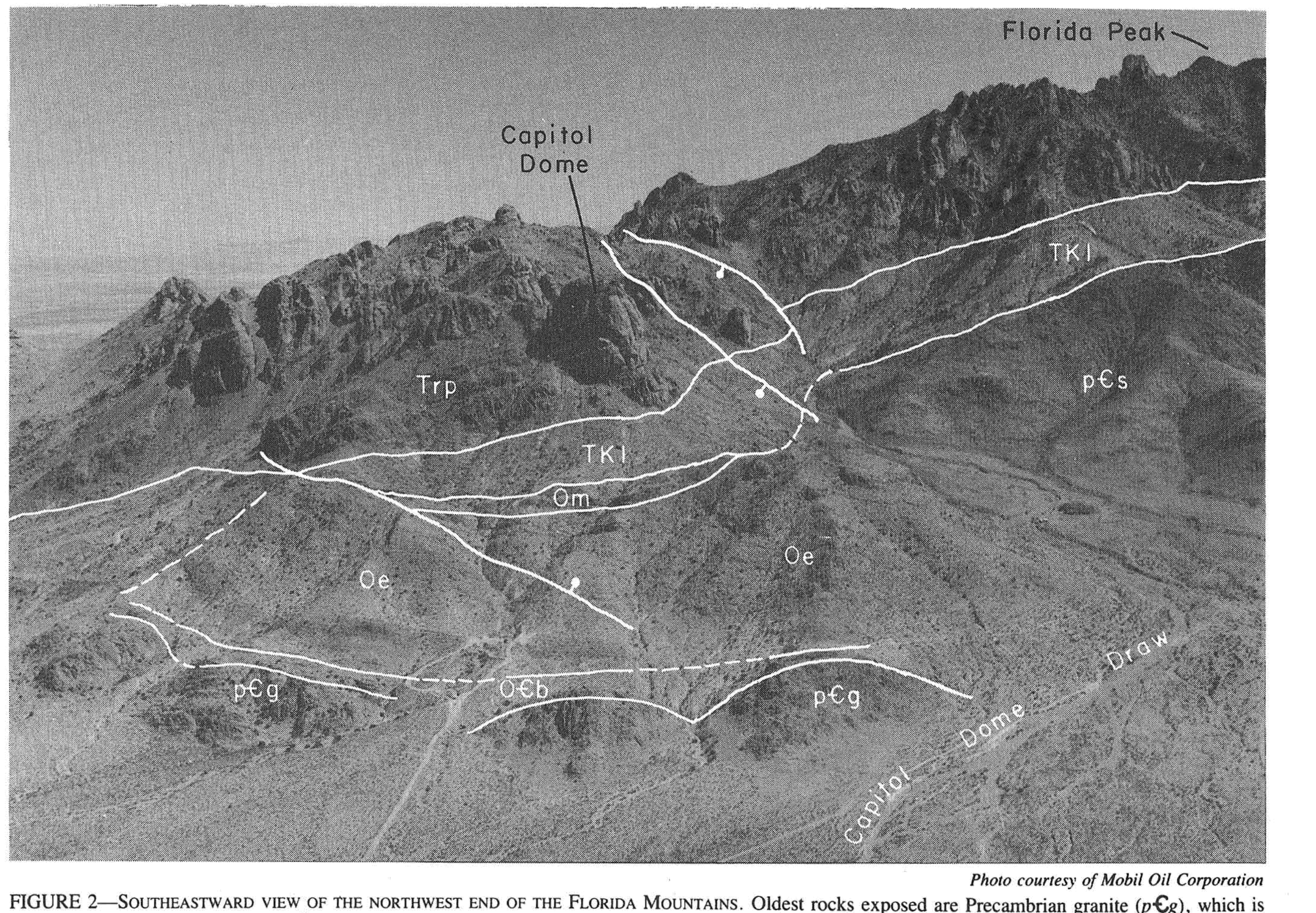


Photo courtesy of Mobil Oil Corporation

FIGURE 2—SOUTHEASTWARD VIEW OF THE NORTHWEST END OF THE FLORIDA MOUNTAINS. Oldest rocks exposed are Precambrian granite (*p€g*), which is overlain by Bliss Sandstone (*O€b*), El Paso Formation (*Oe*), Montoya Formation (*Om*), Lobo Formation (*TKl*), and Rubio Peak Formation (*Trp*). Southeast of Capitol Dome Draw, Precambrian or Early Cambrian syenite (*p€s*) is overlain directly by the Lobo Formation.

The Montoya Formation, which is approximately 130 ft (39 m) thick on the southwest flank of Capitol Dome, disconformably overlies the El Paso Formation. Basal beds are sandy, medium- to coarse-crystalline, dark-gray dolomite (Cable Canyon). These grade upward into typical massive, dark-gray, medium-crystalline dolomite (Upham) with a combined thickness of approximately 60 ft (18 m). Above the Upham are approximately 70 ft (21 m) of thin-bedded, medium-gray, fine- to medium-crystalline dolomite, limy dolomite, and chert nodules and bands comprising the Aleman Dolomite. The Montoya in the map area was partially eroded prior to deposition of the overlying Lobo Formation. Northwest of Capitol Dome only a few feet of Upham Dolomite are present between the El Paso Formation and Lobo Formation, and approximately 5 mi (8 km) southeast of Capitol Dome, outside the map area, approximately 200 ft (60 m) of Cutter Dolomite overlies a complete Aleman section.

Mesozoic (?)–Cenozoic rocks

LOBO FORMATION (*TKl*)—The Lobo Formation forms a continuous outcrop band from Mexican Canyon to the southeast corner of the quadrangle. It rests nonconformably on Precambrian gneisses at its northern end; to the south the Lobo Formation rests with angular unconformity on El Paso and Montoya strata in a downfaulted block at Capitol Dome. The Lobo rests nonconformably on Precambrian quartz syenite from Tubb Spring to the southeast corner of the quadrangle and across the Florida Mountains to its type locality in Lobo Draw on the east side. The thickness of the Lobo Formation ranges from less than 100 ft (30 m) to more than 500 ft (150 m) in this area, primarily due to the irregular topography upon which it was deposited. Its top is an erosional disconformity beneath the Rubio Peak Formation, but the surface does not appear to have been deeply channeled.

The basal part of the Lobo Formation reflects the underlying rock. Where it rests on the Precambrian, the Lobo is a cobble-to-boulder conglomerate with abundant clasts of granite, syenite, gneiss, Bliss Sandstone, and Paleozoic limestone, dolomite, and chert. Upon the El Paso and Montoya rocks west and south of Capitol Dome, the Lobo Formation is a limestone-chert-dolomite cobble conglomerate with red mudstone matrix. This conglomerate may be a karst-filling deposit.

The typical Lobo in the Capitol Dome quadrangle above these basal units is thin- to medium-bedded, light-gray, calcareous silt-

text continued on back

stone and sandstone interbedded with yellowish-brown mudstone and sandstone, red mudstone, and pebble-to-boulder conglomerates. Composition of the conglomerate clasts and sand grains roughly represents an inverted Precambrian–Paleozoic section with Bliss Sandstone and Precambrian rock and mineral types being more abundant in the upper Lobo beds and various Paleozoic limestones, dolomites, and cherts more abundant in the lower beds. A white, calcareous, fine siltstone bed as much as 4 ft (1 m) thick occurs in the Lobo Formation just north of Tubb Spring and also approximately 0.5 mi (0.8 km) northeast of Tubb Spring. This apparently is the bed resembling "lithographic stone" Darton (1916) described as containing 27% calcium carbonate, 10% magnesium carbonate, and 63% material insoluble in acid.

Darton (1916) named the Lobo Formation for its exposures in Lobo Draw and tentatively assigned it a Triassic age. Lochman–Balk (1958, 1974) described the Lobo Capitol Dome section and said its age is unknown. Kottlowski (1958, 1960, 1963, 1965, 1973) and Kottlowski and Foster (1962) believed the type Lobo in the Florida Mountains was probably of Early Cretaceous age. Griswold (1961) concurred with the Early Cretaceous age, and Hayes (1975) referred to the Lobo strata as Cretaceous in age. Dane and Bachman (1965) considered the Lobo to be Early Cretaceous(?) or Tertiary(?) as did Corbitt (1971, 1974), although he seemed to favor a Tertiary designation.

The Lobo section in the southeast corner of the Capitol Dome quadrangle is similar to the well-exposed section in the south-central Victorio Mountains approximately 22 mi (35 km) to the northwest. The Victorio section, which contains a few fossiliferous beds and limestone lenses, was tentatively considered to contain Lower Cretaceous rocks by Bogart (1953). Kottlowski (1960) mapped them as Early Cretaceous in age. Thorman and Drewes (1980), probably influenced by their work in southeast Arizona and southwest New Mexico, mapped these same rocks in the Victorio Mountains as correlative Bisbee(?) Formation of Early Cretaceous age. The Lobo near Capitol Dome appears to be undeformed, whereas underlying Paleozoic beds are intensely deformed, presumably by Laramide stresses. Lobo conglomerate at the south end of the Florida Mountains is cut by a Laramide(?) reverse fault. On the basis of structural relations in the Lobo strata, deposition of the Lobo Formation in the Florida Mountains appears to have been penecontemporaneous with Laramide faulting; therefore, the Lobo Formation in the Floridas is considered to be of Late Cretaceous to early Tertiary age and not correlative to the Victorio Mountains' section.

Darton (1916) also mapped some rocks in the Cooke's Range, Fluorite Ridge, and the southern Florida Mountains as Lobo Formation. Jicha (1954) and Kottlowski (1958, 1963) assigned the section in the Cooke's Range to the Abo Formation with an Early Permian age. Clemons (1982a) designated the section on Fluorite Ridge as Abo because of proximity and similarity to the outcrops in the Cooke's Range. The basal limestone conglomerate with red mudstone matrix in the Cooke's Range, Fluorite Ridge, and Capitol Dome appears very similar. Darton's (1916) and Corbitt's (1971) Lobo Formation in the southern Florida Mountains contains 26 ft (8 m) of basal redbeds overlain by approximately 500 ft (150 m) of conglomerate. Bogart (1953) included the redbeds in the Hueco Formation, essentially an Abo equivalent. Lemley (1982) and Clemons and Brown (1983) will hopefully remove the age enigma of the Lobo Formation.

Rubio Peak Formation (*Trp*)—A thick section of volcaniclastic rocks assigned to the Rubio Peak Formation forms the higher Florida Mountains, Capitol Dome, Dragon Ridge, and Navajo Bill Hill in the southeast corner of the quadrangle. Approximately 1,600 ft (480 m) of reddish-gray to purplish-gray conglomerates, sandstones, and tuffaceous breccias rest disconformably on the Lobo Formation. This disconformity is represented in the Capitol Dome area by a poorly indurated, basal Rubio Peak boulder conglomerate lying on a slightly channeled red Lobo mudstone and by northeasterly dips of the Lobo averaging approximately 25 degrees compared to a 15-degree average for the overlying Rubio Peak strata. The Rubio Peak rocks consist predominantly of material derived from andesitic to dacitic tuffs and lavas with lesser amounts of basalt clasts. The beds are chiefly fluvial deposits, but laharic and talus(?) deposits are common in the lower part.

The basal conglomerate is composed of subangular to well-rounded, up to boulder-size clasts of limestone, cherty limestone, Bliss Sandstone, Precambrian granite and syenite, and volcanic rocks in a tuffaceous, sandy matrix. The conglomerate is overlain by a thick sequence of interbedded sandstones and polylithic breccias with volcanic clasts up to several feet in size. Bedding is commonly thick to massive and, in many places, obscure. Clast size generally decreases upward through the sequence so that the upper beds are fine- to medium-grained sandstones with a few interbedded pebble conglomerates. The sandstones are intensely propylitized, very poorly sorted, plagioclase-rich volcanic arenites with microcrystalline quartz cement. Epidote alteration is common throughout the Rubio Peak sequence.

Darton (1916, 1917b), Lochman–Balk (1958, 1974), and Corbitt (1971) mapped these rocks as Tertiary volcanic agglomerate. Clemons (1982b) tentatively correlated them with the Starvation Draw member of the Rubio Peak Formation (middle to late Eocene) in the Massacre Peak quadrangle (Clemons, 1982a), approximately 20 mi (32 km) to the north. The basal beds in the Capitol Dome area have a similar lithology but lack the abundant Sarten Sandstone clasts found in the Massacre Peak quadrangle where the Rubio Peak was deposited on the Sarten and Colorado Shale. The Sarten Sandstone and Colorado Shale are absent in the Florida Mountains, and the Rubio Peak was deposited on the Lobo Formation. The great thickness of fine-grained fluvial beds and volcanic detritus indicates deposition in a basin adjoining a volcanic source. Preliminary examination of the volcanic clasts, which resemble volcanic rocks in the Tres Hermanas Mountains, suggests that area as a source. One of the Tres Hermanas stocks has a K-Ar age on hornblende of 49.0 ± 2.6 m.y. (Chapin, personal communication, 1981). The Good Sight Mountains to the northeast (Clemons, 1979) or Cooke's Range to the north (Clemons, 1982a) are other possible sources. Equivalent strata overlying the Lobo Formation in the Victorio Mountains were mapped by Kottlowski (1960) as lower Tertiary agglomerates, tuffs, and sandstones. Thorman and Drewes (1980) assigned a Paleocene or Late Cretaceous age to the unnamed sequence in the Victorio Mountains, which underlies rocks from which a 41.7 m.y. fission-track age was obtained.

Evidence obtained while mapping the Florida Mountains and current study of the Lobo Formation by Greg Mack (personal communication, 1983) now indicate that the Starvation Draw member in the Massacre Peak quadrangle and the Lobo Formation in the Florida Mountains probably are correlative. Both units were deposited in response to, and adjacent to, Laramide uplifts. Clast lithology in both units reflects unroofing of fault blocks, and sediment-size distributions indicate fining-upward and basinward sequences. Volcanic detritus is absent in the basal beds but is present in the upper parts of both the Lobo Formation and Starvation Draw member. Therefore, use of the name Starvation Draw member should be discontinued.

Dikes (*Ta, Tb, Tr*)—Hornblende-andesite, basaltic-andesite, and white rhyolite dikes intrude Rubio Peak Formation and older rocks in the northwest Florida Mountains. Thin sections of the mafic dikes indicate that these rocks have undergone considerable alteration. The plagioclase is sericitized and saussuritized(?); the hornblende(?) is totally converted to chlorite, carbonate, epidote(?), and quartz with only the phenocryst outline remaining. Small vesicles are filled with chlorite, carbonate, and quartz. Surprisingly much of the augite (0.1–0.4 mm) in the more mafic dikes appears little altered. The rhyolite is holocrystalline, aphanitic (0.2–0.5 mm), and composed of orthoclase and quartz with minor muscovite, magnetite, and pyrite. Manganese oxide fracture coatings and disseminations are common. The orthoclase contains sericite alteration, and weathered surfaces contain much kaolin.

The dikes have predominant northeasterly trends, but local exceptions occur. A few of the basaltic-andesite intrusions also form sills in the Rubio Peak and Lobo Formations. The dikes are characteristically 4–8 ft (1–2.5 m) thick but pinch and swell from zero to as much as 20 ft (6 m). They apparently were emplaced along en echelon fractures and faults. One of these faults, south of Capitol Dome, cut the Rubio Peak Formation and dropped the Lobo Formation strata down against Precambrian rocks before being intruded by rhyolite. None of these rocks have been dated but are considered to have been emplaced between late Eocene and early Miocene time. They intruded Rubio Peak (middle to late Eocene) and probably were altered by hydrothermal activity associated with the episode of rhyolite and dacite volcanism (Clemons, 1982b) in the Little Florida Mountains.

Rhyolite of Little Florida Mountains (*Tlr*)—Two small dikes of flow-banded rhyolite extend into the northeast part of the Capitol Dome quadrangle. The rock, ranging from grayish pink to dark grayish red, is very finely crystalline and contains less than 1% phenocrysts. These dikes are outliers of the main rhyolite masses underlying the Little Florida Mountains and have a whole-rock, K-Ar age of 23.6 ± 1.0 m.y. (Clemons, 1982b).

Mimbres formation (*QTm* and *Qm*)—Clemons (1982a) proposed using Mimbres formation informally in the Mimbres Basin until current mapping projects in the basin are completed. It is part of what has been mapped previously as Gila Formation (Corbitt, 1971). The piedmont-slope facies of the Mimbres formation (Pliocene-Pleistocene) is composed of mostly alluvial-fan and coalescent-fan deposits and includes thin, colluvial veneers on pediment surfaces. *Qm* is correlative with the Camp Rice Formation piedmont facies (*Qcrp*) in south-central New Mexico and (*Qlp*) in part of southwest New Mexico (Seager and others, 1982). *QTm* is correlative in part with the basal Camp Rice Formation (*Qcrc*) but includes some Pliocene age strata. Remnants of colluvial veneers cemented with caliche are present in the southeast third of the Capitol Dome quadrangle. Thick, alluvial-fan deposits (*QTm* and *Qm*) are prominent south and southwest of Capitol Dome.

QUATERNARY ALLUVIUM—The geology for the northwest two-thirds of the Capitol Dome quadrangle was in large part interpreted from aerial photographs and maps with soil descriptions in the Soil Survey of Luna County, New Mexico (Neher and Buchanan, 1980).

Older piedmont-slope alluvium (*Qpo*) is similar in composition to the Mimbres formation piedmont-slope facies in that it invariably reflects the lithology of local source areas. It includes arroyo-terrace and fan deposits and thin (less than 10 ft; 3 m) veneers on erosion surfaces, generally of late Pleistocene age. Thin soil horizons and weak soil-carbonate accumulations are present in most sections. Arroyo-channel, terrace, and fan deposits associated with *younger piedmont-slope arroyo alluvium* (*Qpy*) range in age from late Wisconsinan to the present (less than 25,000 yrs B.P.). These deposits and the late Pleistocene deposits are the products of repeated episodes of arroyo-valley and partial backfilling (Seager and others, 1975). Zones of soil-carbonate accumulation are weak or absent in the Holocene (less than 10,000 yrs) deposits. An *undifferentiated piedmont-slope alluvium* unit (*Qpa*) is used in areas where *Qpo* and *Qpy* deposits did not warrant mapping separately.

Undifferentiated colluvium-alluvium (*Qca*) have been mapped on slopes where they form a relatively continuous cover on older units. These deposits are generally less than 10 ft (3 m) thick. As expected, the deposits reflect the lithology of nearby higher slopes and ledges. Most of the mapping unit is an age equivalent of older and younger piedmont-slope alluvium (*Qpo* and *Qpy*). Locally, it may correlate with the younger piedmont-slope facies of the Mimbres formation (*Qm*).

Older and younger basin-floor sediments (*Qbfo* and *Qbfy*) cover an extensive area in the northwest part of the Capitol Dome quadrangle. They include loamy to clayey alluvium deposited by distributaries of the Mimbres River in an area essentially unaffected by arroyo incision. The deposits are typically void of gravel, but sporadic, intertonguing gravelly lenses were deposited by flooded arroyos from the Florida Mountains, as well as by ancient Mimbres River floods. These two units are approximately correlative to *Qpo* and *Qpy*, respectively.

Windblown sand (*Qs*) covers a long narrow area along the margin of the piedmont slope and basin floor northwest of the mountains. Small areas of sand cover are also present in secs. 19, 20, 29, 30, and 31, T. 24 S., R. 8 W. The dunes are generally less than 10 ft (3 m) high, and most are somewhat stabilized by desert vegetation. Nearby exposures generally warrant using a double map symbol to indicate the underlying unit, such as *Qs/Qpa*.

STRUCTURAL GEOLOGY

Paleozoic strata in the Capitol Dome quadrangle have predominant southeasterly dips, and Cretaceous–Tertiary strata show predominant northeasterly dips. These prevailing east-dipping attitudes are mostly the result of late Tertiary uplift and eastward tilting along a major northeast-trending fault or en echelon faults (here named the west Florida Mountains fault), which cross the southeast part of the quadrangle. The roads to Rock Hound State Park cross a poorly exposed scarp along this fault approximately 1 mi (1.6 km) northwest of Spanish Stirrup Ranch. This range-bounding, high-angle normal fault probably was activated during the Miocene and remained active, at least intermittently, into Pleistocene time as evidenced by offset of the *Qm* unit in the east-central part of the Capitol Dome quadrangle. Total vertical displacement on the west Florida Mountains fault is estimated to be approximately 3,000–4,000 ft (900–1,200 m). Gravity data compiled by J. O. Lance, G. R. Keller, and P. Daggett, University of Texas (El Paso), indicate a relief of approximately 30 milligals across the fault.

Several smaller, east- and northeast-trending normal faults cut across the northwest end of the Florida Mountains. One of these near the head of Capitol Dome Draw produced approximately 0.2 mi (0.3 km) of left separation of Rubio Peak/Lobo contact as a result of approximately 400 ft (120 m) of vertical movement as the north block moved down relative to the south block. Another fault south of Capitol Dome has been described by Darton (1916, 1917b), Lochman–Balk (1958, 1974), Griswold (1961), and Corbitt (1971). These workers described the fault as: 1) displacing lower Paleozoic rocks down against Precambrian, 2) being intruded by a rhyolite dike, and 3) overlain unconformably by Lobo Formation strata. The first two characteristics are true, but the normal fault, which dips 23–60 degrees northwest, also displaces Lobo and Rubio Peak rocks. Consequently, the age of most recent movements of the northeast-trending faults is post-Rubio Peak (middle to late Eocene) and preemplacement of the white rhyolite dikes (probably Oligocene). A third fault in this set terminates the Montoya Formation outcrop and juxtaposes Rubio Peak strata against El Paso Formation beds northwest of Capitol Dome.

Darton (1916, 1917b) and Corbitt (1971) mapped an east-trending fault in Mexican Canyon. Presumably, this was to account for the termination of lower Paleozoic rocks south of the canyon. No exposures of this fault were observed during this study. One small outcrop in a gully in the extreme northwest corner of sec. 11, T. 25 S., R. 8 W. exposes Lobo Formation resting on Precambrian gneiss. I believe numerous small thrusts and erosion previous to Lobo deposition and the northeasterly dips can account for the lack of Paleozoic or older rocks cropping out north of Mexican Canyon. The Lobo Formation probably underlies colluvium (*Qca* and *Qpo*) at the west end of the canyon, because basal Rubio Peak conglomerates crop out at an elevation of approximately 4,520 ft (1,380 m).

Chaotic structure, in general, prevails in the El Paso and Montoya Formations on the western slopes of Capitol Dome. Most of the features (including thrust faults, high-angle faults, fold axes, and breccia zones) are too small to show at the scale of the map. Three examples not shown on the map are: 1) a dark-gray dolomite bed in the El Paso Formation is broken and repeated three times in the section on the slope west of Tubb Spring; 2) numerous small thrusts in the El Paso strata north of Capitol Dome have formed a megabreccia of angular blocks a fraction of an inch up to tens of feet in size; and 3) Montoya strata form a southeast-plunging syncline northwest of Tubb Spring. The predominant forces appear to have been directed toward the northeast. The combined effects of faulting north of Capitol Dome locally has eliminated Bliss strata, and basal El Paso dolomite rests on Precambrian rocks. Another small thrust cuts the upper Bliss beds in the small saddle west-southwest of Capitol Dome.

The Capitol Dome area may be part of the lower plate or may be part of a block in front of the leading edge of Laramide thrusts, which have been described to the south and southwest of the area (Corbitt and Woodward, 1970, 1973b; Drewes, 1978; Woodward, 1980; Woodward and DuChene, 1981). Darton (1917b) and Corbitt (1971) mapped a west and northwest-trending, high-angle reverse fault (here named the south Florida Mountains fault) across the southern Florida Mountains approximately 3 mi (5 km) south of the Capitol Dome quadrangle. In the area to the south many smaller thrusts have been described (Kottlowski, 1957) and mapped (Corbitt, 1971; Brown, 1982) in the 1–2-mi-wide (1.6–3.2 km) area north of the south Florida Mountains fault. These faults are more continuous and possess greater displacements than the faults at Capitol Dome.

ECONOMIC GEOLOGY

Three mines occur in the Capitol Dome quadrangle. No investigations of the mine workings were made during this study due to their caved nature. The San Antonio mine is in the SE1/4 sec. 10, T. 25 S., R. 8 W., and the Stenson and Copper Queen mines are near the center of sec. 14, T. 25 S., R. 8 W. According to Griswold (1961) the time of discovery and production of the San Antonio mine is unknown. Darton (1916) reported that oxidized zinc ore had been taken from veins in El Paso basal dolomite beds associated with the San Antonio mine, but Lindgren and others (1910) did not mention this mine in their description of the Florida Mountain district. Griswold (1961) briefly described the lead-zinc deposits as containing minor amounts of cerussite and smithsonite. The Stenson and Copper Queen mines are on a steep south-dipping vein-fault zone trending N. 70° E. in the Precambrian hornfelses and quartz syenite. Lindgren and others (1910) and Griswold (1961, 1974) have described these as copper prospects, which contain minor chalcopyrite, pyrite, and malachite.

The age of mineralization is unknown, but I suspect it to be Miocene. The veins more or less parallel the northeast-trending faults and dikes described earlier. Rather intense propylitization is evident in most rocks from Precambrian through the complete Rubio Peak section in the northern Florida Mountains including the rhyolite, hornblende-andesite, and basalt dikes intruded along northeast-trending faults. In the southern Little Florida Mountains dacitic volcanism caused extensive hydrothermal alteration, potassium metasomatism, and probably fluorite, barite, and manganese mineralization (Clemons, 1982b). Contemporaneous activity in the Florida Mountains is a strong possibility.

Numerous sand and gravel quarries, gravel pits, and borrow pits are scattered over the northwest and western parts of the Capitol Dome quadrangle. These alluvial deposits of the ancestral Mimbres River and major Florida Mountains' arroyos are used for building and road construction in the Deming area. Reserves appear to be adequate for many years.

Probably the chief and most valuable resource of the Capitol Dome quadrangle is its ground water or its ground water and fertile soil in the Mimbres Basin. Darton's (1916) study of Luna County was to evaluate and document the ground water and soil of the area. McLean (1977) made another study of the hydrology of the Mimbres Basin, and Neher and Buchanan (1980) made a soil survey of Luna County.

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