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New Mexico Geology, v. 8, n. 1 pp. 5-9,11, Print ISSN: 0196-948X, Online ISSN: 2837-6420.
https://doi.org/10.58799/NMG-v8n1.5

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Petrography and stratigraphy of Seville–Trident exploration wells near Deming, New Mexico

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Abstract

Petrographic analyses of cuttings from four wildcat oil and gas exploration wells drilled by Seville–Trident Corp. near Deming, New Mexico, from 1981 to 1983 are reported. Thickness of upper Tertiary–Quaternary basin fill southeast of Deming is interpreted to be about 4,000 ft. Basin-fill sediments overlie about 5,000 ft of Miocene–Oligocene volcaniclastic rocks and ash-flow tuffs. The Miocene-Oligocene rocks overlie up to 3,600 ft of Rubio Peak Formation (Eocene), which is intruded by a fine-crystalline quartz monzonite. The No. 2 City of Deming well was drilled to a depth of 12,385 ft and bottomed in Rubio Peak Formation. The No. 1 McSherry well was drilled to a depth of 12,495 ft, but cuttings are available only to 12,430 ft. About 300 ft of probable Paleocene Lobo Formation is interpreted beneath the Rubio Peak Formation and above about 570 ft of Precambrian metamorphic rocks. The No. 1 Hurt Ranch well, west of Deming, is reported to have been drilled to a total depth of 7,723 ft. About 2,300 ft of basin fill, 4,800 ft of Tertiary volcanic rocks intruded by rhyolite of Red Mountain, and 440 ft of El Paso Dolomite are represented in the cuttings (deepest cuttings studied were from 7,640 ft).

Introduction

Seville–Trident Corp., of Carlsbad, California, drilled five wildcat oil and gas exploration wells in central Luna County from 1981 to 1983 (Fig. 1). All were completed as dry holes and no shows of oil or gas were found. Wire-line logs were run only on No. 1 City of Deming (total depth of 4,225 ft) and No. 1 McSherry (total depth of 12,430 ft) wells; therefore, stratigraphic correlations with the other wells by this method are not possible. Drill cuttings from all the wells are available. Four wells in the Deming area were selected for this report. The No. 1 State well may be studied later.

The purposes of the study were six-fold: 1) to identify possible source areas for the basin fill (petrographic analysis of the cuttings and petrography done on rocks in surrounding areas [Clemons, 1982a, 1982b, 1984, 1985, in press; Clemons and Brown, 1984] indicate possible provenances for the sediments); 2) to provide data for the thickness and lithology of the basin fill (regional maps [Clemons, 1985] indicate that the deepest part of the Mimbres Basin is a few miles northeast of Deming); 3) to provide a more accurate determination of thicknesses and composition of the Tertiary volcanic rocks (Fig. 2) than can be made of partially exposed and partially eroded sections in surrounding mountain ranges; 4) to interpret Laramide deformation based on thickness and lithology of the Lobo Formation, if present; 5) to determine approximate timing of basin subsidence; and 6) to help locate and determine the extent of the Burro uplift.

Several problems exist with the identification of cuttings and interpreting formation tops in these wells. First, the basin fill (Fig. 2) was derived from volcanic rocks in the Mimbres River drainage basin that are similar (or identical) to rocks that make up the floor of the basin (rhyolites, ash-flow tuffs, and andesites); therefore, cuttings of basin-fill deposits are difficult to distinguish from bedrock cuttings on the basis of lithology. Abundance of well-rounded grains (Fig. 3) generally indicates basin-fill sediments. Second, probable intrusive rocks (Fig. 4) drilled in the No. 1 McSherry and No. 2 City of Deming wells may be interbedded flows or volcaniclastic breccias in the Rubio Peak Formation. Third, faults are difficult to detect in the thick, varied-lithology, volcanic sections. Fourth, cavings of uphole material during drilling appear to have been common and often are abundant in well cuttings. The presence of 30% ash-flow-tuff cuttings at 10,000 ft depth in the No. 2 City of Deming well (1,400 ft below other ash-flow tuffs) is difficult to explain by other means. Fifth, the cuttings are mostly fine to very fine sized, which makes some lithologic identifications difficult. Finally, no wire-line logs were run on the No. 2 City of Deming well, so correlation with the nearby No. 1 McSherry well is not possible by this method.

Methods

Well cuttings of varied intervals were washed and scanned under a binocular microscope. The selected intervals depended on the collection intervals available, types of lithologies present in the cuttings, and bracketing distinctive changes in lithologies. Eighty-five petro-

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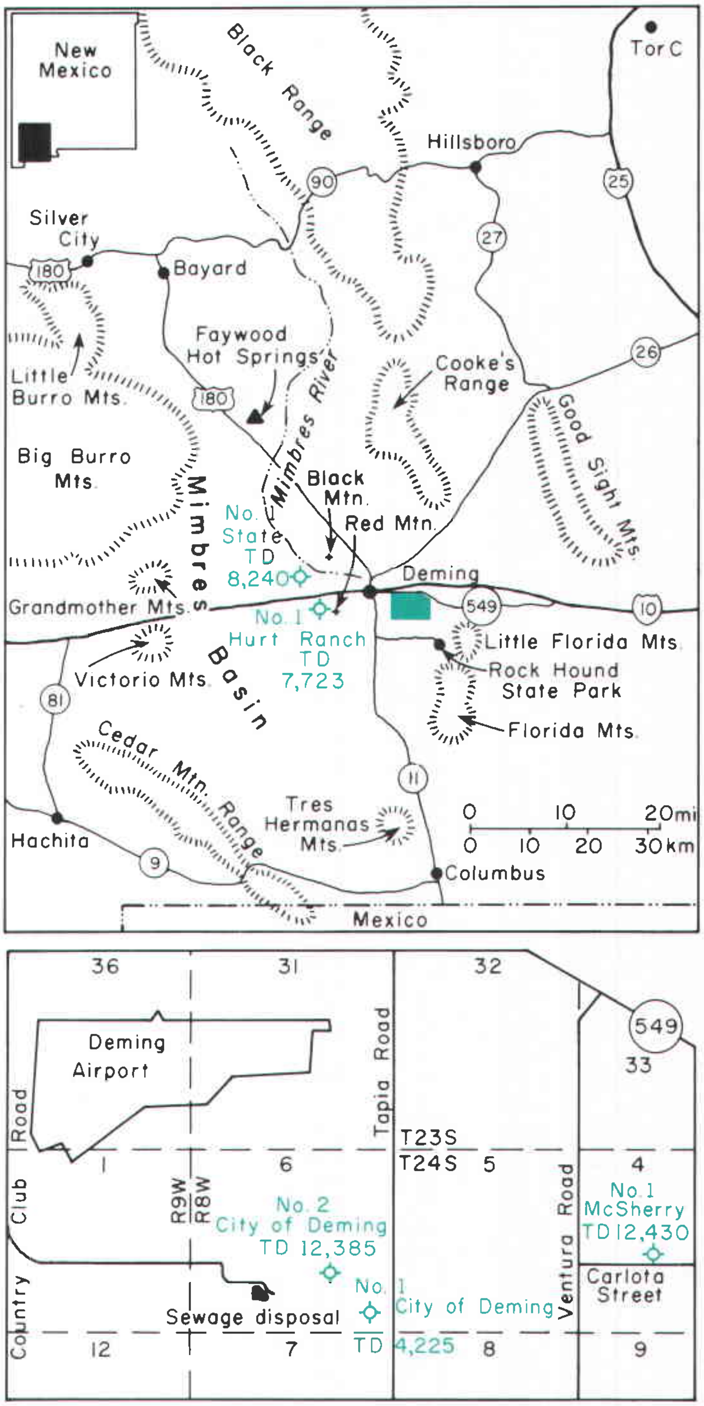

FIGURE 1—Index maps, showing locations of five Seville–Trident wells and the surrounding area. The blue rectangle in the top map represents the approximate location of the more detailed bottom map.

graphic thin sections were prepared from No. 1 City of Deming well cuttings, 138 were prepared from No. 2 City of Deming well cuttings, 110 were prepared from No. 1 McSherry well cuttings, and 55 were prepared from No. 1 Hurt Ranch well cuttings. Petrographic analyses of the thin sections included identification of rock types and point counting 100 grains on each slide. (Photocopies of all grain counts are available from the author upon written request.) It was not considered significant to count more grains because of the varied interbedded lithologies and the apparent abundance of caved material.

Cuttings were collected by the operator from the No. 1 City of Deming well at 5-ft intervals between 800 and 4,225 ft. Cuttings from the No. 2 City of Deming well were collected by the operator at 10-ft intervals between 4,000 and 12,385 ft. Cuttings from the No. 1 McSherry well were borrowed from the New Mexico Bureau of Mines and Mineral Resources and are in envelopes of 30-ft intervals between depths of 1,200 and 12,430 ft. Lithologies of these cuttings were compared with the gamma-ray and neutron-density logs to verify lithologic changes and to further correlate the dominantly volcanic lithologies with the wire-line logs. Cuttings from the No. 1 Hurt Ranch well were collected at 10-ft intervals between 400 and 7,640 ft. Reported total depth is 7,723 ft, but because of lost circulation, no cuttings are available below 7,640 ft.

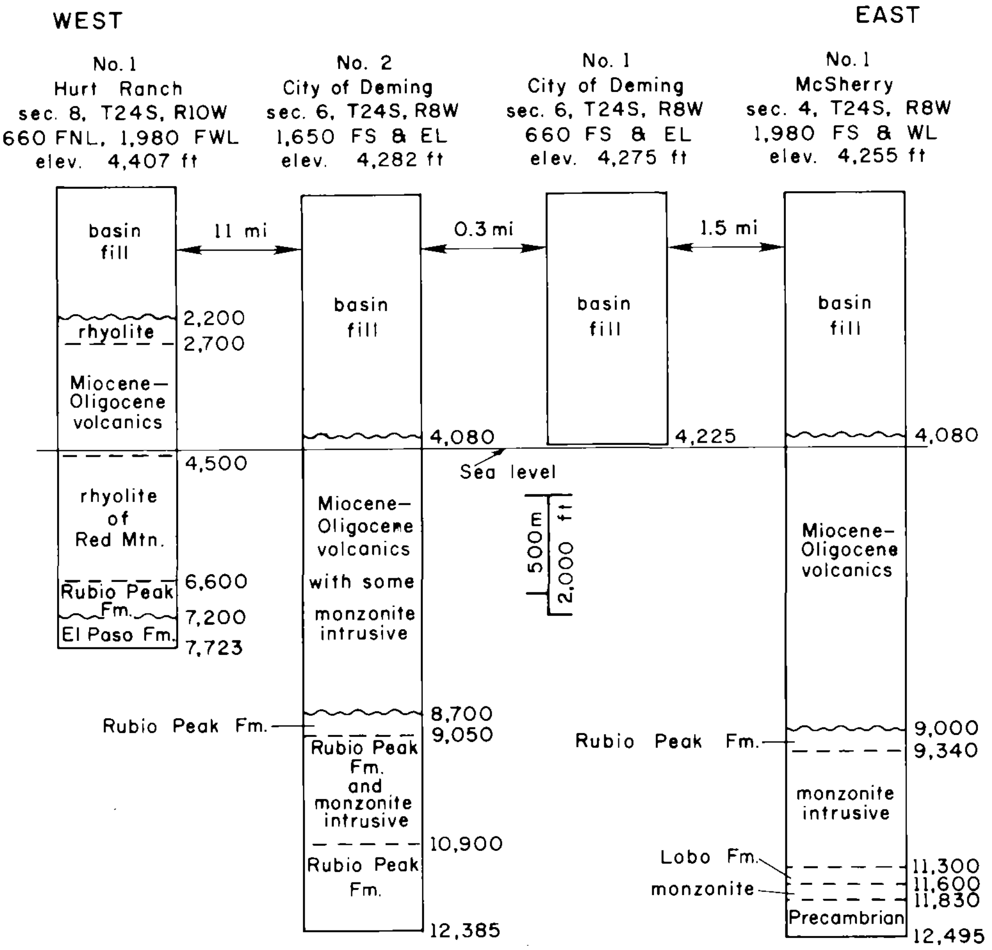

FIGURE 2—Interpreted columnar sections of the four Seville–Trident wells that were studied.

Petrography

Preliminary scanning of cuttings under the binocular microscope and petrographic examination of about 50 thin sections indicated that 10 constituent lithologies could be recognized consistently with relative ease and certainty. Constituents in fine-sized cuttings are counted as individual grains even though they may be parts of larger rock fragments. For example, fine cuttings of a volcanic arenite composed of medium (or larger) sand grains can yield silt to fine-sand-sized fragments of andesite, rhyolite, ash-flow tuff, carbonate (cement), and mudstone (matrix) composition. Cuttings of ash-flow tuffs contain individual crystal fragments of quartz, sanidine, and plagioclase as well as tuff matrix. These and other possible associations need to be considered when interpreting the graphs in Figure 5. Relative percentages of the following 10 components were determined using point counts: andesites, rhyolites, ash-flow tuffs, volcanic arenites, single grains of quartz/sanidine/plagioclase (Fig. 3), plutonic rock fragments (Fig. 6), intrusive rocks (excluding rhyolites and andesites), sandstone/siltstone/mudstone, carbonate rock fragments, and chert.

Andesites

All intermediate to mafic, aphanitic and aphanitic–porphyritic rocks are included under this heading. Most of the cuttings appear to have come from relatively unaltered volcanic and hypabyssal rocks. Intergranular, intersertal, pilotaxitic, and hyalopilitic textures are well represented and microporphyritic hornblende–andesites are common. Cuttings also represent less abundant mafic rocks containing microphenocrysts and granules of pyroxene, olivine, and magnetite. Plagioclase laths in some pilotaxitic textures are as small as 0.002 mm wide and 0.025 mm long; a few of the intergranular textures have equant and tabular plagioclase crystals up to 1 mm in size. Random estimates of plagioclase compositions based on extinction angles ranged from Ab_{40} to Ab_{75} with an average of about Ab_{53} (calcic andesine).

Rhyolites

Included under the heading of rhyolites are the silicic flow and intrusive rocks with hypocrystalline, anhedral-equigranular, spherulitic, hyaline, and seriate textures. Most quartz and feldspar crystals are less than 0.3 mm long and the average size is about 0.05 mm. Blocky oligoclase and biotite microphenocrysts are in a few cuttings; a few subhedral biotite and plagioclase(?) microlites are about 0.02 mm. The basin-fill sediments in No. 1 and No. 2 City of Deming and No. 1 McSherry wells, to depths of 3,400 ft, contain grains of perlitic obsidian probably derived from the Little Florida Mountains. Rhyolite in the No. 1 Hurt Ranch well (Fig. 2) is consanguineous to the Red Mountain rhyolite dome. The degree of crystalinity of the rhyolite of Red Mountain increases with depth from cryptocrystalline-aphanitic at the surface to holocrystalline-aphanitic texture resembling a microgranite in the deepest cuttings (Fig. 7).

Some rhyolite and chert cuttings are difficult to differentiate. Thin sections of known rhyolites and cherts from mountains in and around the Mimbres Basin show that generally the cherts are anhedral-equigranular and typically contain minor amounts of calcite. The rhyolites are less commonly equigranular and typically contain microlites and crystallites. Some small cuttings of devitrified shard-free matrix from ash-flow tuffs may be indistinguishable from rhyolites.

Ash-flow tuffs

Ash-flow-tuff cuttings were derived mostly from vitric and vitric-crystal ash-flow tuffs similar to those exposed in the Little Florida, Tres Hermanas, and Grandmother Mountains; Cooke's, Cedar Mountain, and Black Ranges; and Klondike and Carrizalillo Hills (Clemons, 1982a, b; Elston, 1957; Jicha, 1954; Thorman and Drewes, 1979). Quartz, sanidine, plagioclase, and biotite crystal fragments (averaging <0.5 mm) are contained in a cryptocrystalline and hyaline matrix. The majority of ash-flow-tuff cuttings contain cuspate and platy, axiolitic shards and pumice shards, but ash-flow-tuff cuttings without shards also are common. Devitrified bands in these shard-free tuffs closely resemble intrusive and flow rhyolites.

Volcanic arenites

The volcanic arenites are fine- to coarse-grained sandstones and conglomeratic volcaniclastic rocks. They are composed of varying proportions of basalt, andesite, latite, dacite, rhyolite, and ash-flow-tuff rock fragments along with abundant plagioclase crystal fragments. The matrix is typically clay rich with abundant iron oxides; epidote and chlorite may be present. These arenites are generally cemented with calcite but a few contain microcrystalline quartz cement. Cuttings from these rocks appear more altered than cuttings from volcanic intrusives and

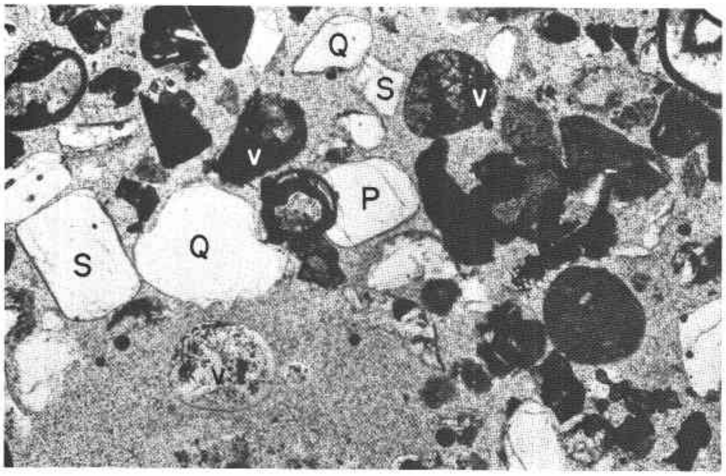

FIGURE 3—Photomicrograph of rounded grains of quartz (**Q**), sanidine (**S**), plagioclase (**P**), and varied volcanic rocks (**v**) from 4,040-ft depth in No. 2 City of Deming well. Crossed nicols; width of field is 3.5 mm.

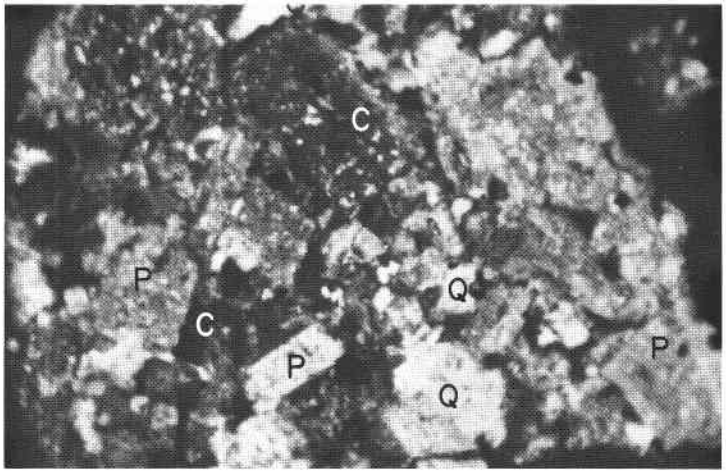

FIGURE 4—Photomicrograph of intrusive consisting of sericitized plagioclase (**P**), quartz (**Q**), and chlorite (**C**) from 10,100-ft depth in No. 2 City of Deming well. Crossed nicols; width of field is 1.3 mm.

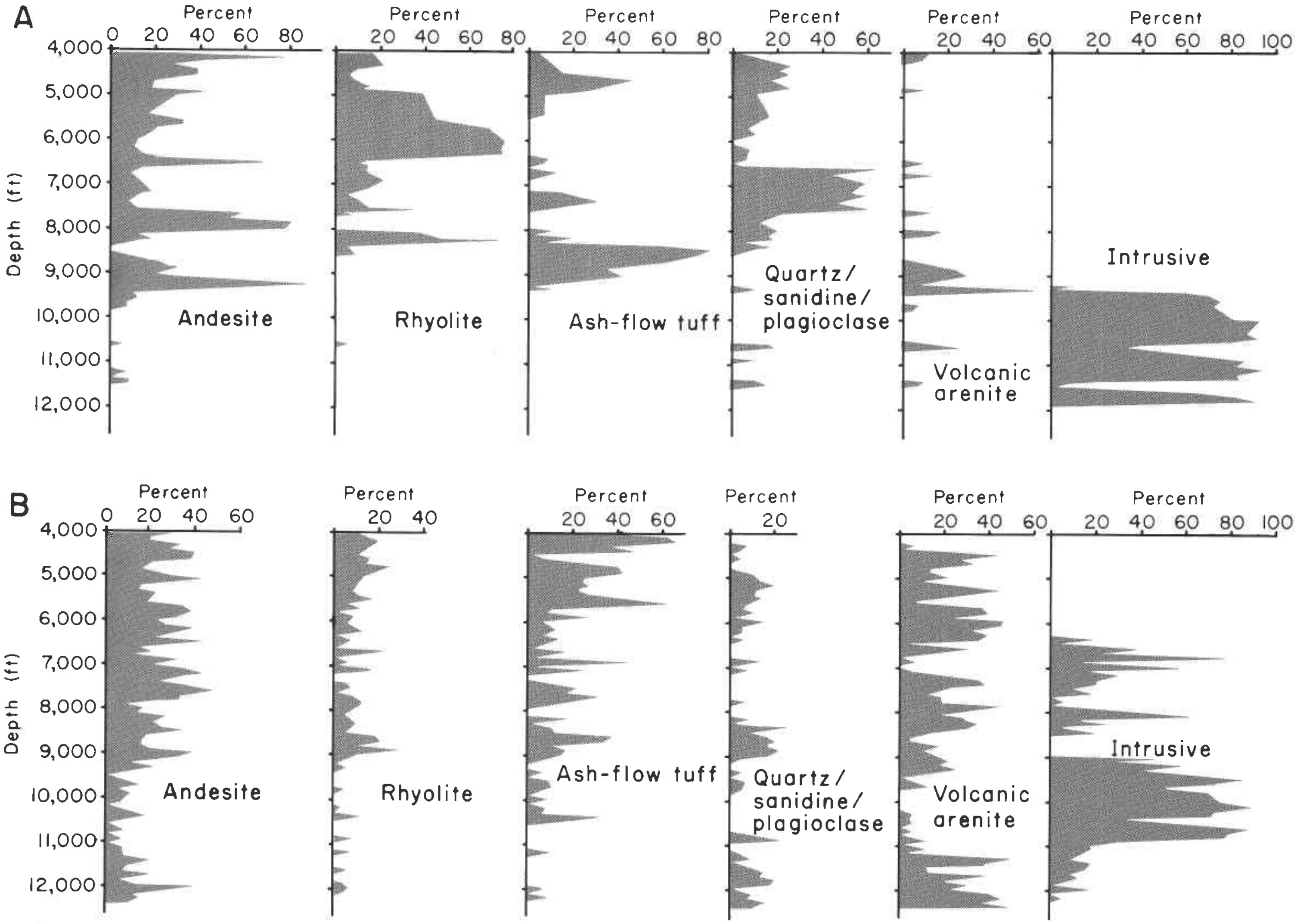

FIGURE 5—Percentage distribution graphs of the composition of cuttings in the No. 1 McSherry well (**A**) and the No. 2 City of Deming well (**B**).

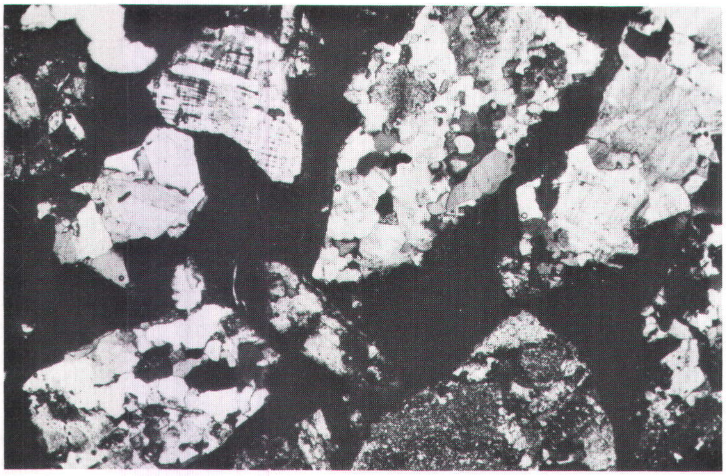

FIGURE 6—Photomicrograph of granite and microcline from 12,100-ft depth in the No. 1 McSherry well. Crossed nicols; width of field is 3.5 mm.

FIGURE 7—Photomicrograph of intrusive rhyolite from 5,700-ft depth in the No. 1 Hurt Ranch well. Plane light; width of field is 1.3 mm.

flows. Cuttings derived from the coarse-grained volcanic arenites appear as individual rock types and, consequently, they were most probably counted as andesite, rhyolite, ash-flow tuff, etc.

Quartz/sanidine/plagioclase

Individual volcanic quartz, sanidine, and plagioclase grains are common components in the well cuttings (Fig. 3). Most were derived originally from ash-flow tuffs and, thus, they can often be grouped with ash-flow-tuff cuttings when interpreting lithologies. The volcanic quartz occurs as monocrystalline, euhedral to rounded and embayed, clear grains without inclusions and possessing straight extinction. Sanidine and plagioclase appear fresh and occur as euhedral, subhedral, and rounded grains similar in size to the quartz. Plagioclase in the ash-flow tuffs is twinned but not zoned. Plagioclase grains occurring at depths below about 9,000 ft are commonly zoned, twinned, fresh, angular fragments probably derived from hypabyssal and plutonic rocks. Anomalous(?) rounding of quartz/sanidine/plagioclase grains from below 9,000 ft is difficult to explain except as derivatives of volcanic arenites.

Plutonic rock fragments

Hornblende gneiss, granitic gneiss, amphibolite, quartz-chlorite schist, gabbroic, and perthitic rock fragments are included in the category of plutonic rock fragments. Only trace amounts of plutonic rock fragments are present in the cuttings except in the bottom of the No. 1 McSherry well. The lack of granite and syenite grains in the basin-fill sediments may be due in part to the fineness of the cuttings. Probably a more important factor was the mechanical and chemical weathering of those rocks before their debris came to rest in the basin. Cuttings below 11,830 ft in the McSherry well are dominantly gneiss and schist, which are similar to Precambrian rocks that crop out north of Capitol Dome and along the south slopes of Fluorite Ridge (Clemons, 1982b, 1984).

Intrusive rocks

Abundant, monolithologic cuttings of fine-crystalline monzonite and quartz monzonite rocks are considered to be derived from intrusive sills, dikes, or small stocks. In thin section, these cuttings appear identical to the Tertiary monzonite of the Florida Mountains described by Clemons (in press). The intrusive cuttings are composed of altered sodic andesine and hornblende (less than 1 mm) in a cryptocrystalline to microcrystalline matrix. Interstitial quartz is fairly common and accessory minerals include iron oxides, apatite, and zircon. Sericitic alteration of the plagioclase is extensive and replacement of hornblende by chlorite and carbonate is quite pervasive. This rock type occurs intermittently in the No. 2 City of Deming well between 6,600– and 9,000-ft depths and is a dominant rock type between 9,000 and 11,800 ft in both the No. 2 City of Deming and the No. 1 McSherry wells.

Sandstone/siltstone/mudstone

Only trace amounts of quartz arenite, arkose, polycrystalline and undulose-extinction quartz, and feldspar grains are present in the cuttings. These are lumped with the more abundant siltstones and mudstones in the sandstone/siltstone/mudstone category. Strictly defined according to composition, the siltstones and mudstones may also be volcanic arenites, but the grains are too small to identify easily. Most grains in the siltstones appear to be angular to subangular quartz and feldspar embedded in a calcareous mud matrix. Sandstone/siltstone/mudstone lithologies are significant fractions of the cuttings above 4,100-ft depth (basin fill) and below 10,900-ft depth in the No. 2 City of Deming well. The only cuttings vaguely similar to the Lobo Formation calcareous siltstone, sandstone, and shale in the Florida Mountains came from 11,300- to 11,600-ft depths in the McSherry well (Fig. 2).

Carbonate rock fragments

Most of the carbonate rock fragments are spar calcite and calcareous alteration products of volcanic rocks and muddy matrix material. Much of the spar calcite could be derived from vein fillings. No significant quantities (more than 1–2%) of verified limestone fragments are present in the cuttings. Dolomite is present in the cuttings from 11,390- to 11,600-ft depths in the McSherry well, and it is the dominant rock type below 7,200 ft in the Hurt Ranch well. The general lack of carbonate rock fragments in the basin fill (except in Hurt Ranch well) is somewhat surprising, considering the volume of Paleozoic carbonate rocks exposed in nearby mountains.

Chert

Trace amounts of chert can be seen in some cuttings but chert is not a significant component in any of the wells studied. Up to 9% chert occurs in one interval of the Hurt Ranch well. Otherwise, even basin-fill sediments and probably Lobo Formation rocks produced fewer than 5% chert cuttings. See the discussion above under rhyolites for an explanation about distinguishing rhyolite from chert in the well cuttings.

Interpretive stratigraphy

The purpose and organization of this section are not to build a chronological geologic history from Precambrian to present, but to visualize what the Deming area looked like with the onset of basin-and-range faulting. This deformation uplifted mountains that provided the detritus to fill the contemporaneously downdropped Mimbres Basin (Fig. 1). The stratigraphic section under the basin fill should represent the complete rock record, which was only partly preserved after periods of erosion, in the surrounding mountains. An inverse stratigraphic section (younger to older) will be discussed because the wells were drilled from the present-day surface downward into the older basement rocks (Fig. 2).

No unusual rocks were observed; all cuttings are similar or identical to rocks previously described in the Mimbres River drainage by Clemons (1982a, b, 1984, in press), Elston (1957), Jicha (1954), and Thorman and Drewes (1979).

Pre-basin-and-range surface

Central Luna County was mostly, if not completely, surfaced by Tertiary volcanic rocks at the onset of basin-and-range deformation about 20 m.y. ago. Eocene volcanism had probably buried all older rocks exposed during the Laramide orogeny. Examples of the Eocene volcanic rocks are now well exposed (encircling the Mimbres Basin) in the Victorio, Grandmother, Good Sight, Florida, and Tres Hermanas Mountains as well as in the Cedar Mountain, Cooke's, and Black Ranges. Ash-flow tuffs from dominantly Oligocene eruptions probably blanketed the area by early Miocene time (23.7 m.y. ago). These ash-flow tuffs crop out sporadically in the Big Burro, Grandmother, Little Florida, and Tres Hermanas Mountains and in the Cedar Mountain, Cooke's, and Black Ranges. The ash-flow-tuff terrane was dotted with a few rhyolite flows and basaltic andesite vents and flows in latest Oligocene to early Miocene time (26–23 m.y. ago). The rhyolites include those in the Little Florida Mountains, along the Mimbres Valley north of Faywood Hot Springs, and probably the rhyolites in the Victorio Mountains and Red Mountain. Basaltic andesites in southern Cooke's Range, Black Mountain, and southeast Little Florida Mountains are penecontemporaneous with the rhyolites (26–23 m.y. old). As the Mimbres Basin subsided along basin-and-range faults, the Eocene- to Miocene-age volcanic rocks provided most of the basin-fill materials.

Basin fill

The thickness of basin-fill sediments east of Deming is probably about 4,000 ft. The boundary between bedrock and overlying sediments deposited with the onset of basin-and-range deformation in Luna County is difficult to place both in the cuttings and on the wire-line logs of the McSherry well. The sediments were derived from rocks in surrounding ranges that are similar or identical to those rocks that make up the floor of the subsiding basin. Consequently, lithologies of cuttings do not change significantly from above to below the basin floor. Generally, the cuttings of basin-fill sediments contain greater percentages of well-rounded grains. Possibly the basin fill at the McSherry well is only 3,160 ft, as indicated by Sam Thompson, III (written comm., May 1983).

The No. 1 City of Deming well may have penetrated the basin floor at 3,900-ft depth. Percentages of ash-flow tuffs are much greater below 3,900 ft, but lithologies are quite variable to a total depth of 4,225 ft. If the ash-flow-tuff cuttings were derived from in situ ash-flow tuffs, it seems that they should prevail for 10's or 100's of feet. The No. 2 City of Deming well cut dominantly ash-flow tuffs between 4,080 and 4,400 ft and intermittently at greater depths (Fig. 5B). Therefore, the top of the Miocene–Oligocene volcanic sequence (underlying basin fill) is placed at 4,080 ft. The No. 1 McSherry well penetrated an andesite flow or intrusive between 4,080 and 4,150 ft (Fig. 5A). Abundant well-rounded grains are in cuttings from above 4,080 ft and angular varied-lithology grains are in cuttings from below 4,150 ft; therefore, the top of the Miocene–Oligocene volcanic sequence is placed at 4,080 ft. The No. 1 Hurt Ranch well penetrated intrusive rhyolite at a depth of 2,300 ft. The cuttings between 800- and 2,300-ft depths are chiefly reddish-brown, calcareous mudstone and siltstone with minor amounts of dolomite and volcanic rock fragments. These rocks are interpreted to be Upper Tertiary basin fill rather than Lobo Formation (S. Thompson, III, written comm., April 1984). The fine-grained clastic rocks are underlain by volcanic rocks resembling those cropping out in the Victorio and Grandmother Mountains to the west and the Rubio Peak Formation to the east and north. Therefore, the thickness of post-Oligocene basin fill north of Red Mountain is estimated to be 2,300 ft.

The abundance of rhyolite cuttings from the No. 1 McSherry well between 3,250 and 4,080 ft and in the No. 2 City of Deming well at about 4,080 ft probably indicates initial faulting and subsequent erosion of the Little Florida Mountains rhyolites. Rhyolite cuttings remain an important constituent in the No. 1 City of Deming well to a depth of 2,100 ft, which probably represents continued uplift on the basin-bounding faults. Perlitic obsidian, identical to the perlitic obsidian at Rock Hound State Park in the Little Florida Mountains, is common in the cuttings of No. 1 City of Deming and No. 1 McSherry wells to depths of 3,400 ft.

Miocene–Oligocene volcanic sequence

Ash-flow tuffs are interbedded with volcaniclastic rocks, andesites, and latites to depths of 9,000 ft in the McSherry well and to depths of 8,700 ft in the No. 2 City of Deming well. Ages of ash-flow tuffs determined on samples from nearby areas range from 29 to 36 m.y., so this 4,600–4,900-ft sequence, enclosing the ash-flow tuffs, is considered to be mostly Oligocene in age. The upper beds may be early Miocene and the basal beds may be late Eocene.

The hypabyssal rock intrudes the Rubio Peak Formation (Eocene) in the McSherry well and the central part of the Oligocene volcanic section in the No. 2 City of Deming well. Therefore, the age of the fine-crystalline quartz monzonite postdates early Oligocene and may be as young as early Miocene.

Rubio Peak Formation

The No. 2 City of Deming well cut Rubio Peak Formation (Eocene) and hypabyssal intrusive rocks from 8,700 to 12,385 ft. The intrusive provided most of the cuttings from 9,000- to 10,900-ft depths (Fig. 5B). Below 10,900 ft the cuttings are distinctly Rubio Peak type (andesitic volcanic arenites and calcareous, altered siltstone) to a total depth of 12,385 ft. The No. 1 McSherry well penetrated similar rocks from 9,000 to 11,830 ft, except for the 300-ft interval between 11,300- and 11,600-ft depths (Fig. 5A). Cuttings from this 300-ft section may represent the Lobo Formation (Paleocene). Lithology of these cuttings resembles, but is not identical to, the Lobo in the Florida Mountains. Unfortunately, 230 ft of hypabyssal intrusive between the Lobo(?) and the Precambrian metamorphic rocks at 11,830-ft depth (Fig. 2) occupy the interval that might include the basal conglomerates of the Lobo Formation. The Lobo is assumed to be absent in the Hurt Ranch well because 600 ft of volcanic arenites overlie El Paso Dolomite. These volcanic arenites closely resemble basal Rubio Peak rocks that rest on the Hell-to-Finish Formation (Lower Cretaceous) in the Victorio Mountains (Greg Mack, pers. comm. 1984).

Pre-Tertiary rocks

As expected, the older subsurface stratigraphy of the wells reflects the stratigraphic relations observed in the Florida, Victorio, and Big Burro Mountains. That is, the northwest-trending Burro–Florida uplift Elston, 1958) was segmented by basin-and-range faulting and underlies the Mimbres Basin between the Florida and Big Burro Mountains. No Mesozoic or Paleozoic rocks were penetrated by the wells studied, except the El Paso Formation (Lower Ordovician) in the bottom of the No. 1 Hurt Ranch well.

Precambrian gneiss, schist, hornfels(?), and some microcline-bearing granite were drilled below 11,830 ft in the McSherry well. Rubio Peak Formation is the oldest rock that was drilled in the No. 2 City of Deming well, at a depth of 12,285 ft, about 1.7 mi west of the McSherry well (Fig. 1). Thus, there is a minimum of 555 ft of relief (855 ft if 300 ft of Lobo Formation is assumed to be present at both locales) on top of the Precambrian between the two wells. This may be due to faulting but could just as conceivably be due to an erosional topography developed on the Lobo and Precambrian rocks in post-Laramide and pre-Rubio Peak time.

ACKNOWLEDGMENTS—I thank Frank E. Kottlowski, Director, and the New Mexico Bureau of Mines and Mineral Resources (NMBMMR) especially for financial assistance during this project and for continuous support of my geological investigations in southwestern New Mexico. I thank Rudy Greenbaum, President of Seville–Trident Corp., for providing the well cuttings and wire-line logs for study. I am grateful also to Robert Bieberman and Sam Thompson, III, NMBMMR, for assistance in the core and cuttings library and discussions relating to interpretations of the cuttings and logs. Robert Cooper and Paula Newcomer were very helpful in washing the well cuttings and making petrographic thin sections. The manuscript was improved by thorough re-

continued on page 11

Mountains, as "cotypes" of the new species (p. 36). P 21.3, P 21.4, P. 11.00, and P 11.8, all of which were illustrated in Bulletin 14, were found at a locality near Jemez Springs in the Jemez Mountains. However, P 11.00 and P 11.8 were not sent to the U.S. National Museum (Table 2).

Cotypes of *Triticites rhodesi* are listed in Bulletin 14 (p. 45) as including numbers P 31.0, P 31.1, P 31.2, and P 31.3; however, Needham only sent P 31.0, P 31.1, and P 31.3 to the USNM.

Polydiexodina guadalupensis was a new species described in Bulletin 14 (pp. 58–59) with cotypes listed as P 13.0, P 13.1, P 13.2, P 13.3, and P 13.4. P 13.0, P 13.3, and P 13.4 were illustrated in the text. However, none of these specimens are shown on Needham's list to Henbest (Table 1).

The rediscovery of a portion of Needham's fusulinid collections is encouraging. We are very grateful to F. J. Collier for his efforts to locate the U.S. National Museum holdings and for providing copies of related correspondence. It is not impossible that the remaining specimens are in collections elsewhere and may yet be retrieved. We urge any readers of this article with knowledge of Needham's collections to contact us.

Reference

Needham, C. E., 1937, Some New Mexico Fusulinidae: New Mexico Bureau of Mines and Mineral Resources, Bulletin 14, 88 pp. ☐

Name	Number of spec. on slide or in container	U.S. National Museum (USNM) numbers	Collector's No.	Source
Schwagerina thompsoni n. sp	2 (vial)	101120 c	P 32.000	Hueco ls. near Hueco Tanks, El Paso Co., Tex.
	1 (slide)	101120 d	P 32.9	
"	2 (slide)	101120 a & b	P 32.10	"
"	2 (slide)	101120 e & f	P 32.11	"
Triticites cuchilloensis n. sp.	2 (slide)	101113 a & b	P 26.1	Middle Magdalena Cuchillo Mts. Sierra Co., New Mexico
"	2 (slide)	101113 c & d	P 26.2	"
Triticites fresnalensis n. sp.	2 in vial	101117 f	P 3.0	Top of Magdalena fm. Fresnal Canyon, Otero Co., New Mexico
"	4 (slide)	101117 a, b, & d	P 3.1	"
"	1 (slide)	101117 g	P 3.2	"
"	2 (slide)	101117 c & e	P 3.3	"
"	2 (slide)	101117 h & i	P 3.4	"
Triticites gallowayi n. sp.	2 (slide)	101115 a & e	P 8.1	U. Magdalena fm. La Luz Canyon, Otero Co., N.M.
"	2 (slide)	101115 b & f	P 8.2	"
"	1 (slide)	101115 c	P 8.3	"
"	2 (slide)	101115 d & g	P 8.4	"
Triticites jemezensis n. sp.	6 (vial)	101116 d	P 11.0	Top Magdalena fm. Jemez Springs, N. Mex.
"	2 (slide)	101116 a & b	P 11.2	"
"	3 (slide)	101116 c	P 11.4	"
Triticites kellyensis n. sp	2 (slide)	101112 e & f	P 21.1	Upper Magdalena; Kelly, N.M.
"	1 (slide)	101112 g	P 21.2	"
"	2 (slide)	101112 a & c	P 21.3	"
"	2 (slide)	101112 b & d	P 21.4	"
Triticites rhodesi n. sp.	1 (box)	101122 c	P 31.0	Upper Magdalena, Rhodes Canyon, Socorro Co., N. M.
"	1 (slide)	101122 a	P 31.1	"
"	1 (slide)	101122 b	P 31.3	"
Triticites ventricosus var. *sacramentoensis* n. var.	2 (vial)	101111 a & b	P 5.0	Up. Magdalena, La Luz, Otero Co., N. Mexico
"	1 (slide)	101111 d	P 5.2	"
"	2 (slide)	101111 c & e	P 5.3	"
Triticites wellsi n. sp.	2 (slide)	101114 c & e	P 23.1	Magdalena fm. Barton, Santa Fe County, New Mexico
"	1 (slide)	101114 f	P 23.2	"
"	1 (slide)	101114 b	P 23.3	"
"	2 (slide)	101114 a & d	P 23.4	"

TABLE 2—Specimens that were illustrated in Bulletin 14 that are still lost.

Name	Collector's number	Source
Staffella atokensis (?)	P 38.2, P 39. 2	Lower Magdalena Fm., Kingston, NM
Ozawainella sp.	P 48.2	Valle de Ojo de la Parida, Socorro Co., NM
Fusulina euryteines	P 37.1, P 37.2	Sangre de Cristo Mts.; 15–20 mi east of Taos, NM
Fusulina pattoni	P 15.0, P 15.2	Hermosa Fm., Archuleta Co., CO
Fusulina socorroensis	P 16.2	Lower Magdalena Fm., Socorro Mts., Wand, NM
Wedekindellina euthysepta	P 37.1, P 37.2, P 22.1	Montezuma Hot Springs, San Miguel Co., NM Tijeras Canyon, east of Albuquerque, NM
Wedekindellina excentrica	P 22.3, P 22.4, P 22.6, P 22.7	Tijeras Canyon
Triticites nebraskensis	P 33.3	North end of Sierra Los Pinos, 6 mi southeast of Scholle, Socorro Co., NM
Triticites ventricosus	P 9.3, P 2.0, P 2.1, P 2.4	Cedro Canyon, Manzano Mts. Alamogordo, NM
Triticites kellyensis	P 11.0, P 11.8	Jemez Springs in Jemez Mts., NM
Triticites sp. A	P 20.3	Coyote Hills, Socorro Co., NM
Triticites rhodesi	P 31.2	Upper Magdalena Fm., Rhodes Canyon, Socorro Co., NM
Schwagerina emaciata	P 1.000, P 1.23	Jarilla Mts., about 4 mi north of Orogrande, Otero Co., NM
Schwagerina huecoensis	P 32.7, P 32.8	About 2 mi northeast of Hueco Tanks, El Paso Co., TX
Pseudoschwagerina fusulinoides	P 32.0, P 32.4, P 32.5, P 32.6	Near Hueco Tanks, El Paso Co., TX
Pseudoschwagerina uddeni	P 32.00, P 32.1, P 32.2	Near Hueco Tanks, El Paso Co., TX
Polydiexodina guadalupensis	P 13.0, P 13.1, P 13.2, P 13.3, P 13.4	Guadalupe Point, TX

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views and suggestions by Sam Thompson, III, and Roy Foster.

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