Third-day road log: Northern Animas Mountains

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THIRD-DAY ROAD LOG, NORTHERN ANIMAS MOUNTAINS

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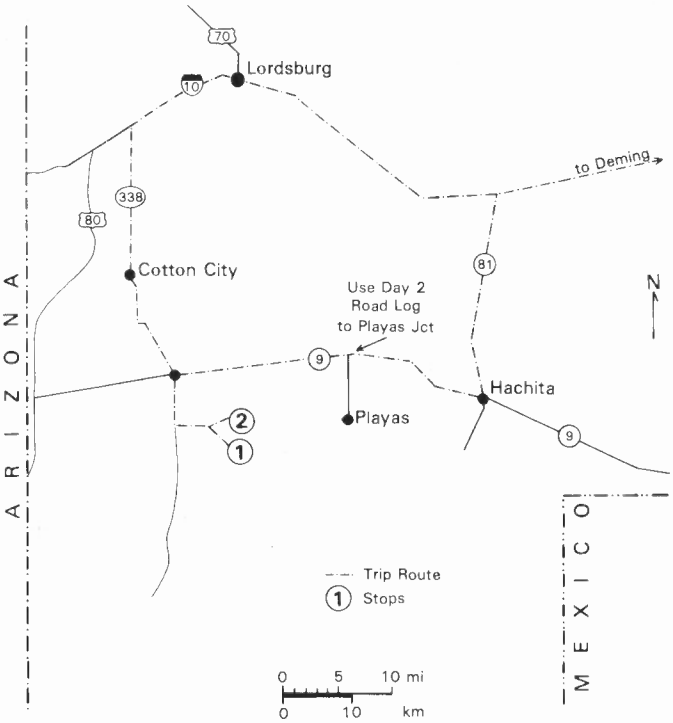
SATURDAY, OCTOBER 8, 1988

Assembly point: East side of 11th Street (heading north) at Pine Street, west side of Deming.
Departure time: 8:00 a.m.
Distance: 201.3 mi
Stops: 2 plus 1 optional



SUMMARY

The third-day tour will visit the north end of the Animas Mountains along the Continental Divide. The route will proceed west on I-10 and use appropriate parts of Second-Day Road Log to the junction of NM-9 and road to Playas Townsite. Today we will continue west on NM-9 to Animas and then south on NM-338 before turning east and entering the northern Animas Mountains through the Albert Johnson Ranch. While on the ranch lands, please drive only on the road followed by the caravan and do not litter. This part of the Animas Mountains has been mapped several times (Zeller, 1959; Soule, 1972; Drewes, 1986; Wilson, 1986; Donnan, 1987). Unfortunately, in our opinion, none of the maps "tell the whole truth." The purpose of today's trip is to provide the conferees with time to visit two areas and study many of the stratigraphic units as well as observe some of the complex structural features. Debates and observations are welcome from one and all!

Stop 1 will be near the center of Paleozoic-Mesozoic outcrops, at the southern edge of sec. 18, T28S, R18W. Here we will see (1) the similarities (and differences?) between the Upper Cambrian Bliss Ss and Upper Cretaceous Mojado Ss; (2) thrust or depositional boundary of Bliss on Precambrian granite; (3) controversial Bliss-El Paso Formation relations; (4) Upper Cretaceous U-Bar Formation; (5) 34.9 my quartz monzonite, probably emplaced in a Laramide fault zone; and (for the late Paleozoic aficionados) (6) an opportunity to identify some Horquilla-Concha-Epitaph(?) strata.

Stop 2, near the northwetern end of the mountains, will provide access to one of the thrust faults that has placed Mississippian Escabrosa and Pennsylvanian Horquilla limestones over Upper Cretaceous-lower Tertiary Ringbone Formation. There will also be ample time to examine some Montoya-El Paso beds and fusulinid-bearing Horquilla Limestone.

Mileage

0.0 MP81 on I-10 west side of Deming. I-10 parallels the SP RR through southwestern New Mexico.

The 167 mi of SP RR was built across New Mexico territory in less than one year. Incorporated April 14, 1879 as the Southern Pacific Railroad Company (of New Mexico), construction proceeded eastward from Arizona. By Sept. 1880 tracks entered New Mexico and trains started serving Lordsburg on Oct. 18 and Deming on Dec. 15 (Fig. 3:0.0). The line bridged the Rio Grande

FIGURE 3:0.0a. SP RR depot Harvey House, Deming, Feb. 1, 1893. Photo courtesy Museum of New Mexico. Neg. No. 13840.

at Anapra and arrived in El Paso on May 19, 1881. One of the reasons justifying the Gadsden Purchase in 1853 was that this SP route included the lowest crossing of the Continental Divide (1398 m) west of Deming (Myrick, 1970). The Continental Divide was marked with signs so train passengers would realize they had crossed the "backbone" of North America. **65.3**

CLIMATE OF SOUTHWESTERN NEW MEXICO

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The writings of the Spaniards of the 16th, 17th and 18th centuries indicate that these conquerors were more interested in salvation and metal wealth than they were in the climate and agricultural potential of New Mexico. Other than the harsher winters encountered in the north, New Mexico was much like the great expanse of New Spain they had crossed. Many of the Anglo explorers and surveyors, based in large part on their eastern backgrounds, found New Mexico to be a barren, desolate wasteland. John R. Bartlett of the U.S. section of the Boundary Commission visited southwestern New Mexico in 1851 and wrote of being sickened and disgusted by the monotony of the area.

FIGURE 3:0.0b. Railroad roundhouse, Deming, ca. 1895. Photo courtesy Museum of New Mexico. Neg. No. 13839.

Shortly thereafter, military personnel, especially medical officers of the late 19th century, wrote extensively on the health benefits of the New Mexico climate. The migration to New Mexico of health seekers and sun lovers began about 100 years ago and continues (Tuan et al., 1969). Deming especially has experienced unprecedented growth in recent years, due in large part to the arrival of retirees from the north.

There are six long-term weather stations operating in the field conference area. These stations and the years of record used in this discussion are: Animas (1931–1986), Columbus (1941–1986), Deming (1899–1986) (Table 3:0.0a), Gage (1899–1986), Hachita (1918–1986) and Lordsburg (1913–1986) (Table 3:0.0b). Unless otherwise cited, all data are from the Office of State Climatologist, 1988.

The stations range in elevation from a low of 4,160 feet at Columbus to a high of 4,505 feet at Hachita, suggesting that average temperatures across the region should be quite similar. Of the six stations, Columbus has the highest mean annual temperature (62.0°F) and Gage the lowest (59.4°F). Mean annual temperature range, the difference between the warmest month and coldest month, ranges from a high of 39.1°F at Lordsburg to a low of 37.4°F at Hachita. Record high temperatures are 108°F (Hachita), 110°F (Animas, Columbus, Deming, Lordsburg) and 111°F (Gage). All were recorded during the period late June–early July, just prior to the start of the summer wet season. The range in record low temperatures is surprisingly great, from –7°F at Columbus to –19°F at Animas. All record lows were recorded in the months of December and January. The wide range of record lows, unlike the narrow range of record highs, suggests local influences on the temperature, such as cold air drainage into valleys from adjacent uplands.

Precipitation is sparse throughout the region. The annual averages are 9.26 in. (Deming), 9.34 in. (Columbus), 10.01 in. (Gage), 10.37 in. (Hachita), 10.64 in. (Animas) and 10.91 in. (Lordsburg). The precipitation of the driest year ranges from 2.76 in. at Deming to 4.73 in. at Animas, both in 1956. By contrast, the wettest year varies between 15.58 in. at Columbus (1984) and 22.01 in. at Deming (1986). Maximum 24-hour precipitations range from a low of 2.08 in. at Hachita to 4.07 in. at Animas. Of the total annual precipitation, 40% is received during the summer season (June–August), though on average the three-month period of July–September is everywhere the wettest, when 75–80% of all thunderstorms occur. Annual thunderstorm frequency increases from 50 along a line between Deming and Columbus to 80 at the Arizona border (Changery, 1981). Snowfall averages 2.9 in.–5.0 in. annually across the lowlands, but a record 23.2 in. was received at Hachita in 1982. Evaporation from free water surfaces averages 70–75 in. annually, one of the highest rates in the southwestern U.S. (Farnsworth et al., 1982).

TABLE 3:0.0a. Temperature and precipitation averages, Deming, New Mexico, 1899–1986.

	Temperature (°F)			Precipitation (inches)				
	Max	Min	Mean	Mean	High	Yr	Low	Yr
January	56.9	25.8	41.4	0.42	1.59	85	0.00*	70
February	61.9	29.3	45.6	0.53	2.18	31	0.00*	84
March	68.2	34.3	51.3	0.42	2.36	26	0.00*	72
April	75.8	40.8	58.3	0.24	1.87	05	0.00*	86
May	85.1	48.8	66.9	0.22	1.50	16	0.00*	83
June	94.7	58.6	76.6	0.47	3.32	03	0.00*	82
July	94.6	65.1	79.8	1.90	7.13	11	0.01	03
August	92.3	63.3	77.8	1.78	5.40	16	0.00*	62
September	87.6	56.6	72.1	1.34	6.38	58	0.00*	73
October	78.0	44.4	61.2	0.83	3.85	28	0.00*	52
November	65.7	32.9	49.3	0.46	3.94	86	0.00*	70
December	57.2	26.8	42.0	0.65	2.90	14	0.00*	73
Annual	76.5	43.9	60.2	9.26	22.01	86	2.76	56
Winter	58.7	27.3	43.0	1.60	4.79	05	0.00	02
Spring	76.4	41.3	58.8	0.88	4.02	05	0.00*	60
Summer	93.8	62.3	78.1	4.15	11.00	14	0.99	48
Fall	77.1	44.6	60.9	2.63	7.92	58	0.00	08

Source: State Climatologist 1988 * Also earlier years

TABLE 3:0.0b. Temperature and precipitation averages, Lordsburg, New Mexico, 1913–1986.

	Temperature (°F)			Precipitation (inches)				
	Max	Min	Mean	Mean	High--Yr		Low--Yr	
January	57.9	25.8	41.8	0.80	2.82	49	0.00*	86
February	63.2	28.0	45.6	0.73	2.43	13	0.00*	84
March	69.4	33.7	51.6	0.69	3.65	26	0.00*	84
April	78.3	39.6	59.0	0.26	1.46	41	0.00*	78
May	86.7	47.9	67.4	0.21	2.10	28	0.00*	74
June	96.0	58.4	77.3	0.49	3.60	81	0.00*	80
July	96.6	65.2	80.9	1.81	5.34	81	0.15	35
August	93.9	63.0	78.4	2.12	8.28	57	0.00*	62
September	89.2	56.6	72.9	1.36	7.05	58	0.00*	73
October	79.1	44.3	61.6	0.95	5.01	72	0.00*	82
November	66.6	31.7	49.2	0.60	3.89	13	0.00*	80
December	59.0	26.0	42.6	0.89	4.46	14	0.00*	81
Annual	78.0	43.3	60.7	10.91	19.70	14	4.68	24
Winter	60.0	26.6	43.3	2.42	6.41	15	0.10	64
Spring	78.1	40.4	59.3	1.16	4.45	26	0.00	59
Summer	95.5	62.2	78.9	4.42	10.73	57	1.09	13
Fall	78.3	44.2	61.2	2.91	8.95	83	0.00*	56

Source: State Climatologist 1988 * Also earlier years

Wind summaries are available only for Columbus, but are probably representative of the region. Wind speeds are greatest during spring, the driest season, and lowest in the fall. Annual wind frequency is 49.9% from the SW-W-NW, and 30.5% from SE-E-NE. The westerly flow is dominant in spring and is associated with the middle-latitude westerlies and accompanying mid-latitude storm systems. The easterly component is strongest in the wet season of late summer–early fall, when moist air is advected into the region from the Gulf of Mexico and the eastern Pacific by the subtropical high pressure system located over the western Atlantic. Spring dust storms are a special hazard in the region, though their frequency and severity decrease from east to west. The annual number of dust episodes with visibility less than seven miles averages 20 at Columbus and just two at the Arizona border (Changery, 1983).

According to the Koeppen system of climate classification, Animas, Deming, Gage, Hachita and Lordsburg are the drier margin of the BS (steppe) climate. Columbus, being the warmest and second driest station, falls precisely on the boundary between the BS (steppe) and BW (true desert) climate. However, other climate classification schemes, including several modifications of Koeppen, categorize the field conference area as desert. Certainly in terms of surface drainage, vegetation and soils, it seems prudent to regard all or nearly all of the region as the northern extension of the Chihuahuan Desert.

65.3 Junction of NM-9 and Playas road. **Continue west** to Animas. **0.4**

65.7 Caution. Cross railroad tracks. This railroad was built by Phelps Dodge to bring concentrates and supplies to its Playas smelter and to ship copper ingots from the smelter. **0.4**

66.1 MP28 (from Arizona). Animas Mtns from 9:15 to 11:00, Chiricahua Mtns in distance at 12:00. **2.0**

68.1 MP26 (from Arizona). Crossing center of Playas Valley. Schwennesen (1918) indicated an ancient Lake Playas extended another eight km north of here. John Hawley is currently preparing a manuscript including descriptions of these ancient lakes of southwestern New Mexico for the GSA. **1.0**

69.1 Original site of Playas established about 0.3 km south of here July 18, 1912. Its post office was discontinued Oct. 15, 1917. **1.2**

70.3 MP25. Road on right to Playas Valley community. **0.8**

71.1 MP23. Roadcuts ahead in ash-flow tuffs probably belonging to the Oligocene volcanics of Pothook (Thorman, 1977) mapped in the Coyote Hills to the northeast. **1.0**

72.1 MP22. Beacon Hill at 10:00, and low rounded hills from 9:00 to 11:00 are poorly consolidated cobble-boulder Gila cgls overlying Oligocene volcanic rocks. The clasts are dominantly volcanic. **1.0**

73.1 MP21. The northern Animas Mtns at 9:30 contain outcrops of most of the Paleozoic and Cretaceous-lower Tertiary rock units reported in southwestern New Mexico. Precambrian granite is exposed beneath the Bliss Ss in several places. A combination of Laramide and Basin-and-Range faulting, and subsequent igneous activity, erosion and colluvial deposition has produced a puzzling array of geologic features in this northern segment of the range. Similarities of the following rock units apparently led some workers astray: (1) Bliss and Mojado Ss; (2) Percha Sh and Paradise Fm; (3) the massive unfossiliferous parts of the Horquilla and Escabrosa Fms; (4) volcanic-rich Ringbone and Hidalgo Vols. A quartz monzonite stock intruded what is believed to be a west-trending, high-angle, strike-slip(?) fault about 3.2 km south of the high ridge of Horquilla Ls at 9:30 (Donnan and Wilson, 1986; Drewes, 1986). One of several northwest-trending thrust faults has placed Horquilla and Escabrosa Ls (lower cliffs) on steeply dipping to overturned Mojado and Ringbone beds that overlie the slopes north of the mountain front. Most of the high-angle faults have northerly trends. **0.2**

73.3 Crossing Continental Divide. **0.8**

74.1 MP20. South end of the Pyramid Mtns at 3:00. Ash-flow tuffs from 36-my-old Muir cauldron form most of the central and southern Pyramid Mtns (Deal et al., 1978; Elston et al., 1983). **1.0**

75.1 MP19. The Chiricahua Mtns, in Arizona, are on far horizon at 12:00. They are also dominated by an Oligocene ash-flow tuff sequence, ranging in age from 32 to 25 my (Shafiqullah et al., 1978). Marjaniemi (1968) proposed the Turkey Creek cauldron in the Chiricahua Mtns as the source of about 450 km^3 of ash-flows comprising the Rhyolite Canyon Fm. These are the rocks that form the spectacular weathered forms in Chiricahua National Monument.

The Peloncillo Mtns are in the middle distance from 10:00 to 2:00; exfoliated Preacher Mtn at 2:00 in the central Peloncillos. Between North Antelope Pass (12:00) and Cowboy Pass (1:00) the 27 my Weatherby Canyon Tuff forms north-dipping dark-brown ledges. It overlies about 300 m of rhyolite flows, tuffs and volcaniclastics exposed in North Antelope Pass and southward to Gray Mtn (11:30). North Antelope Pass is considered to be on the northern rim of the Rodeo cauldron which probably extends westward to the Chiricahua Mtns (Deal et al., 1978). **2.0**

77.1 MP17. Small conical hill at 1:00 is middle Tertiary volcanic rocks. **2.0**

79.1 MP15. **Slow,** entering downtown Animas, home of the perennial 2A football Champion Panthers. **0.8**

79.9 Junction, **turn left** (south) on NM-338. **0.1**

80.0 Junction, **continue straight** (south) on NM-338. NM-

9 to right goes through North Antelope Pass and connects with US-80 in the San Simon Valley. **1.2**

81.2 Cattleguard. Northern Animas Mtns at 10:00. Animas Peak (2601 m) at 11:55 is composed of Park Tuff overlying Gillespie Tuff. The Park Tuff (Zeller, 1962; Zeller and Alper, 1965) is believed to have been erupted from the San Luis cauldron just south of the Mexican border about 28 my. The Gillespie Tuff (32 my) is believed to have come from the Cowboy Rim cauldron southeast of Animas Peak (Elston and Erb, 1977; Erb, 1979). Gray Mtn at 1:30, Indian Peak at 1:00.

Directly north of the Cowboy Rim cauldron, Pennsylvanian, Permian and Cretaceous rocks are folded into the Winkler anticline, site of minor silver and fluorspar mineralization, and the KCM No. 1 Forest Federal well drilled in 1974–75. The well encountered contact metamorphosed sedimentary rocks and quartz monzonite porphyry from 688 m to total depth of 1361 m. Elston and Erb (1977) interpreted the anticline as draped over an intrusion in the ring-fracture zone of the Oligocene (35 my) Juniper cauldron. The central cauldron subsidence zone occupies the relatively low part of the Animas Mtns from Gillespie Peak (2228 m) at 11:00 to Whitmire Pass, about 16 km to the north. This area is occupied by the thick, caldera-fill, Oak Creek Tuff, caldera-collapse breccia, and a central quartz monzonite porphyry (Animas stock), interpreted as cogenetic with Oak Creek Tuff (Zeller and Alper, 1965; Elston and Erb, 1977; Erb, 1979). **1.0**

82.2 Cattleguard. About 40 km south of here, in sec. 10, T33S, R20W, the ARCO Exploration Co. No. 1 Fitzpatrick well was drilled in 1984–85 on the floor of the uppermost end of the Animas Valley. It was drilled to a total depth of 3291 m with no oil or gas shows reported. Sam Thompson (written commun. 1986) reported the following tops: surface valley fill, 286 m Tertiary volcanic rocks, 1702 m U-Bar Fm(?), 2198 m Epitaph Fm, 2466 m Colina Fm, 2658 m metamorphosed Paleozoic rocks (to TD). Deal et al. (1978), Erb (1979) and Elston et al. (1983) had projected the western margin of the 37 my Tullous cauldron through the vicinity of the well site. **2.5**

84.7 Cattleguard. **Slow,** prepare for left turn. **0.2**

84.9 **Turn left,** cross cattleguard onto gravel road. Small rodeo arena on right. Northern Animas Mtns from 10:30 to 1:00, Animas Peak at 3:00. **0.5**

85.4 Irrigation wells in this part of the Animas Valley pump water from the upper part of the Gila Cgl. **0.9**

86.3 Cattleguard, entering Alfred Johnson ranch headquarters. **Slowly** proceed straight ahead to wire gate southeast of house. **0.2**

86.5 Y-fork in road just east of gate. **Bear right** and proceed across wide piedmont slope. **1.4**

87.9 Cross small arroyo incised in piedmont. **1.1**

89.0 Y-fork in road; **bear right** on maintained ranch road. Jeep trail to left leads to abandoned mines (Fig. 3:89.0). **0.2**

89.2 Sharp curve to right and cross arroyo. **0.3**

89.5 Low rounded hill at 3:00 is composed of El Paso dol overlying Bliss Ss. Cross arroyo. **0.2**

89.7 Pass through wire gate. Coarse-crystalline Precambrian granite or quartz monzonite(?) exposed in arroyo and on few slopes to left of road. The deeply-weathered, brownish- to reddish-gray rock contains about 27% quartz, 34% microcline, 32% sodic plagioclase, 5% chloritized biotites and 2% accessory magnetite, apatite, sphene and zircon. Shafiqullah (written commun. 1983) reported an 1190 my Rb/Sr age for a much altered sample. **0.2**

FIGURE 3:89.0. View north of high ridge in northern Animas Mtns. Complexly faulted rocks range from Bliss Ss to Horquilla Ls (on skyline).

89.9 Low hill nearby at 9:00 is Bliss Ss dipping about 40° northeastward. Is the contact with granite a thrust or normal fault? **0.2**

90.1 Y-fork, **bear left.** High peak at 2:00 is part of the Continental Divide. It is composed of thick section of Horquilla Ls. Nearby hill at 12:05 is composed of Bliss Ss and El Paso dol (overturned or faulted?). Slope at 2:00 is underlain by U-Bar Ls downfaulted against the Bliss and El Paso. **0.1**

90.2 Corral on left, water well and pump on right. **Bear right** at road fork east of corral. **0.4**

90.6 **STOP 1.** Please follow flagperson's directions as this will be a tight turn around of the caravan. Grass is scarce here so please protect it for the cows.

We will first proceed across Mojado Ss and U-Bar Ls to the hilltop south of the road. This will provide a vantage point for an overview of the geology of the northern Animas Mtns and surrounding areas (Figs. 3: 90.6a, b).

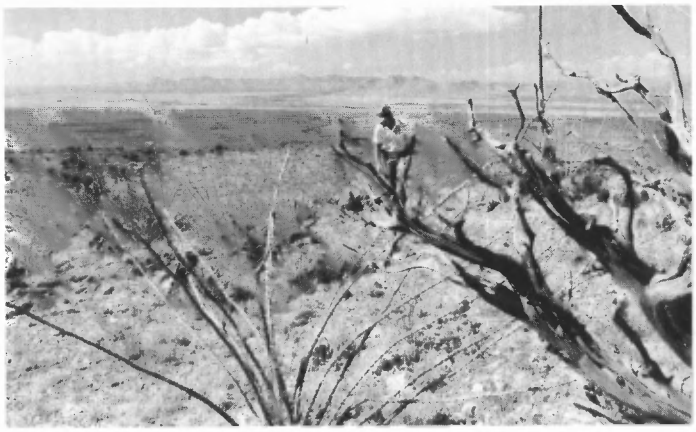

FIGURE 3:90.6a. View west-southwest from Stop 1 across Animas Valley to southern Peloncillo Mtns.

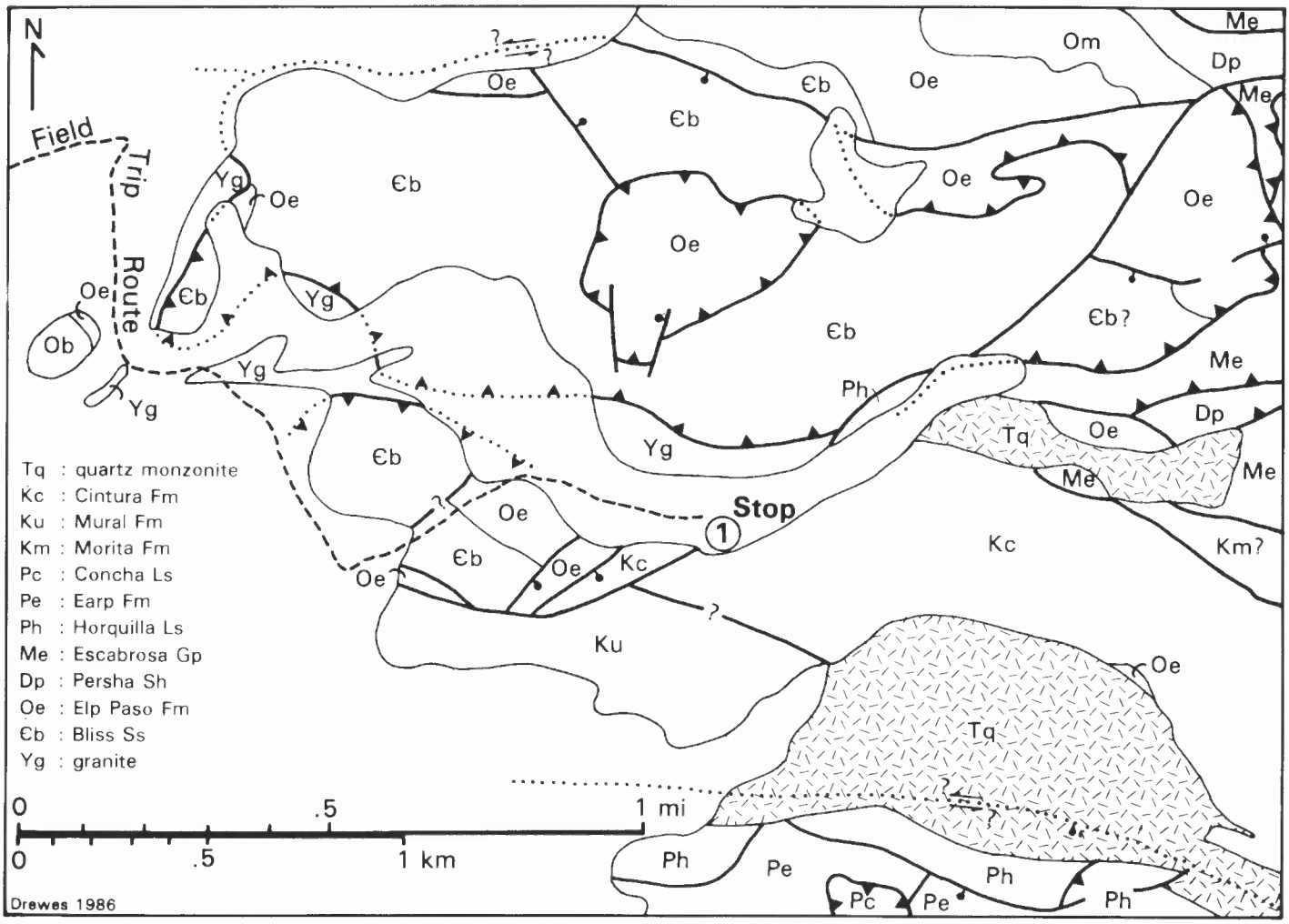

FIGURE 3:90.6b. Geologic map of Stop 1 area (from Drewes, 1986).

A west-northwest-trending quartz monzonite pluton (Fig. 3:90.6c) crosses the range east of here. It is believed to have been emplaced along a high-angle Laramide fault. The fine-crystalline rock contains about 14% quartz, 35% plagioclase, 42% orthoclase, 7% biotite and hornblende and 2% accessory magnetite, apatite and zircon. Drewes (1986) reported a K/Ar age of 35 my for a biotite concentrate. Rocks comprising the mountains for about four km south of the pluton are dominantly upper Paleozoic limestones, but a small area about two km east of here contains poorly exposed, faulted, lower Paleozoic rocks. Farther south the mountains are comprised of volcanic rocks, most associated with the 34 my Juniper cauldron (Elston and Erb, 1977).

FIGURE 3:90.6c. View southeast from Stop 1. Probable fault zone is occupied by quartz monzonite stock (Tq) that intruded Mural Ls (Ku) and Cintura Fm (Kc) on the north and Horquilla Ls (Ph) on the south.

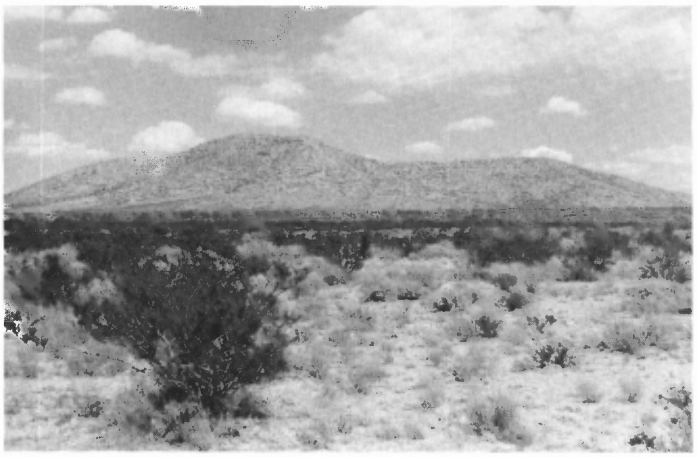

FIGURE 3:96.0. Hill of southwest-dipping Horquilla Ls at northwestern end of Animas Mtns.

Most, if not all, Cretaceous and lower Tertiary rocks and Precambrian granite crop out only north of the fault zone and pluton. The northern end of the Animas also contains a complete, but complexly faulted, Paleozoic section.

After the overview discussion, conferees are urged to examine for themselves (1) the pluton-fault relations, (2) similarities of the Bliss and Mojado sandstones, (3) the Bliss-granite boundary north of the caravan or (4) Bliss-El Paso boundary north of the caravan.

Retrace route to Y-fork by Johnson Ranch house. **4.1**

94.7 Y-fork, **bear right** and head northeast toward northwest end of Animas Mtns. **0.9**

95.6 Low hill at 3:00 is flow-banded rhyolite, similar to many dikes in the northern Animas Mtns. Vertical foliation trends N40W across the hill. **0.4**

96.0 Elongate hill at 10:00 (Fig. 3:96.0) is Horquilla Ls thrust northeastward over Ringbone Sh. **0.7**

96.7 Low foothills at 3:00 are westward-dipping Horquilla Ls intruded by several northeast-trending rhyolite dikes. **0.1**

96.8 Water tank. **Turn sharp left** (north). **0.5**

97.3 Crest of saddle, Beacon Hill at 12:00 composed of Gila Cgl. Road on very poorly exposed Ringbone after crossing concealed thrust fault (Fig. 3:97.3). Low hill at 3:00 is composed of west-dipping Horquilla(?) Ls downfaulted against Montoya and El Paso dol. Just ahead road crosses unexposed boundary(?) of Ringbone on Mojado. **0.2**

97.5 Water tank on right. **0.1**

97.6 **STOP 2.** The purpose of this stop is to examine a thrust fault exposed along the lower part of the north-facing cliff that brings limestones of the Horquilla Fm (Penn.-

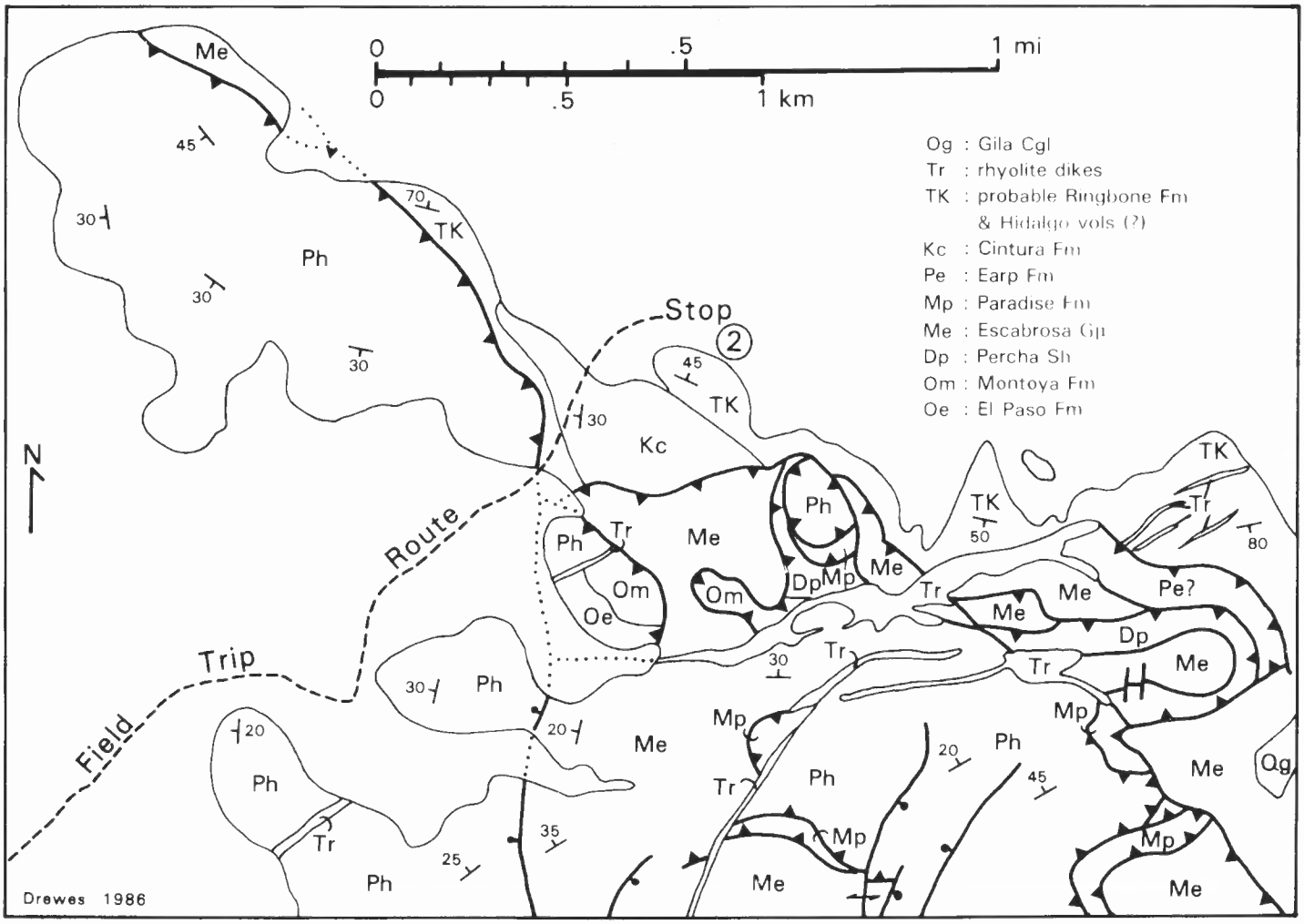

FIGURE 3:97.3. Generalized geologic map of northwestern Animas Mtns (modified from Drewes, 1986).

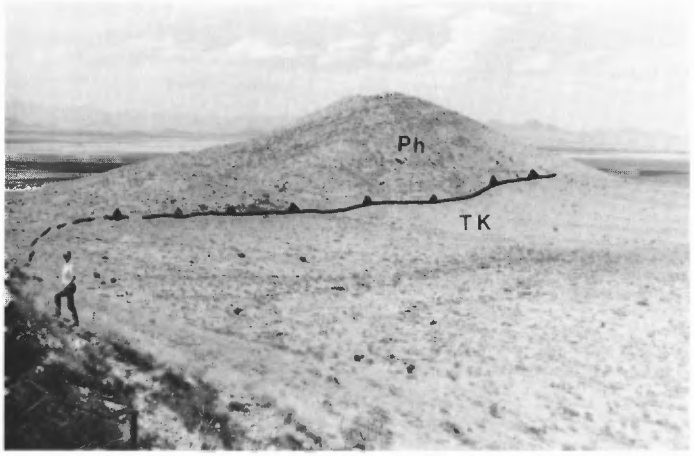

FIGURE 3:97.6. View northwest from Stop 2 showing Horquilla Ls (Ph) thrust over Ringbone Fm (TK).

FIGURE 3:111.8. Preacher Mtn in central Peloncillo Mtns.

Perm.) over coarse conglomerates in the Ringbone Fm (Upper Cretaceous-lower Tertiary?) (Fig. 3:97.6). A few hundred meters north of the cliff, the Ringbone Fm unconformably overlies sandstones and shales of the Mojado Fm (Lower Cretaceous).

Retrace route to Johnson Ranch house. **3.0**

100.6 Pass through wire gate, **slow** by house on right. **0.7**

101.3 Tank Mtn (1746 m) and Little Tank Mtn from 10:00 to 11:00 and Red Hill at 11:30 are composed of middle Tertiary rhyolite flows, tuffs and breccias; capped by quartz latite porphyry flows. The breccias contain huge (to 30 m) blocks of Paleozoic(?) limestones (E. Deal, oral commun. 1978). Limestone Hill (1430 m) at 1:00 composed of upper Paleozoic limestones. Slopes for several miles this side of Limestone Hill are underlain by basalt flows erupted from a cone of 11:59. Deal et al. (1978) reported a K/Ar age of 0.511 my on this basalt along NM-9 west of Animas. Marvin et al. (1978) reported a K/Ar age of 0.14 my. **1.0**

102.3 Stop sign, cattleguard, **turn right** (north) on NM-338 to Animas. **4.9**

107.2 Junction, **continue straight on NM-338.** NM-9 to left crosses Quaternary basalt flows west of Animas. **0.1**

107.3 Junction, **continue straight** on NM-338. Cotton City 12, Lordsburg 37. Low hills from 2:00 to 3:00 are composed of Oligocene volcaniclastics and ash-flow tuffs. **0.5**

107.8 MP33 (from Mexico). North Antelope pass at 9:00. Peloncillo Mtns north of the pass are mostly Weatherby Canyon Tuff to Cowboy Pass (10:00). **2.0**

109.8 MP36. Threemile Hills at 2:30 are mostly ash-flow tuffs of the Rimrock Mountain Gp about 36–34 my. These rocks were erupted following formation of the Muir cauldron about 36–37 my. **1.0**

110.8 MP36. Small hill at 1:00 is composed of Oligocene volcanic rocks; light-gray hill at 1:30 is composed of Naco Gp limestones (Drewes et al., 1985). **1.0**

111.8 MP37. Preacher Mtn (Fig. 3:111.8) at 11:30, just north of Granite Gap, is a quartz monzonite stock. Eight age determinations on the stock range from 29.8 to 36.5 my (Drewes and Thorman, 1980b). **1.3**

113.1 Highway curves right (north). **1.7**

114.8 MP40. Small hill in foreground at 2:30 is more Oligocene volcanic rocks (Drewes et al., 1985). Butte behind small hill (Fig. 3:114.8) is Table Top Mountain (1405 m), composed of volcanic breccias shed off the southern Pyramid Mtns (Deal, oral commun. 1978). **1.5**

116.3 Highway curves left (northwest) by cotton gin on right. **0.5**

116.8 MP42. Entering suburbs of Cotton City. **0.4**

117.2 Highway curves right (north) and proceeds down the Animas Valley for about 14 mi to I-10. Elevation here is 1293 m. **2.6**

119.8 MP45. Blue Mtn (1761 m) at 9:00 is composed of Horquilla Ls. **0.7**

120.5 **Continue straight.** NM-145 to left connects with US-80 northeast of Granite Gap. North of Granite Gap and Preacher Mtn, the central Peloncillo Mtns are composed of Paleozoic and Cretaceous rocks for about 6.5 km. The rocks have been folded and faulted so that the prominent structural trend is northwest, cutting diagonally across the mountains (Gillerman, 1958; Armstrong et al., 1978; Drewes and Thorman, 1980a, b). A major fault may have been intruded by the Oligocene pluton of Granite Gap-Preacher Mtn, similar to what we saw in the northern Animas Mtns. **2.1**

122.6 **OPTIONAL STOP.** Valley View Community Church on left. Gravel road to Hotwells and greenhouses heated

FIGURE 3:114.8. Table Top Mtn southeast of Cotton City.

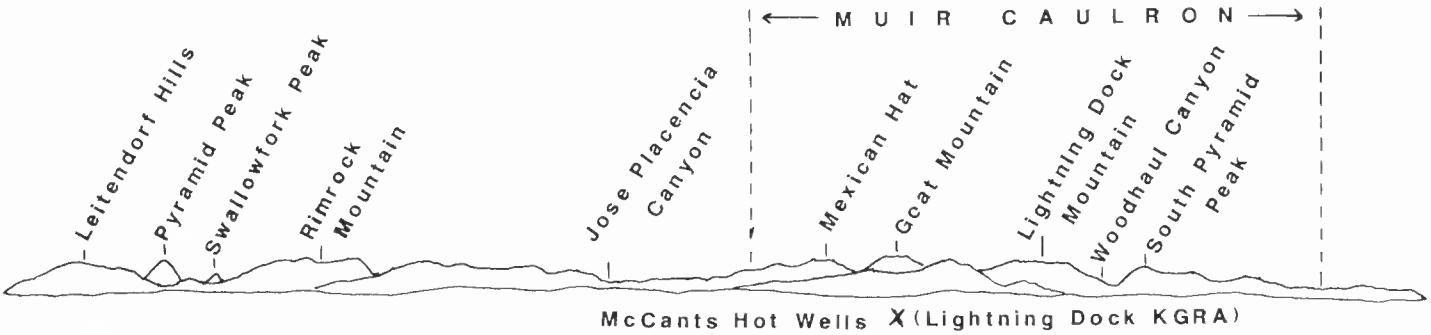

FIGURE 3:122.6. Sketch of west side of Pyramid Mtns.

with geothermal waters from the Lightning Dock KGRA on right. See Fig. 3:122.6 for features in the Pyramid Mtns from 2:00 to 4:00.

In 1985, the Steam Reserve Corp. No. 55-7 Animas Valley geothermal exploration well was drilled to 2134 m near the base of Lightning Dock Mtn. Water at 133°C seems to be controlled by the intersection of the western ring-fracture zone of the Muir cauldron and the northeastern projection of a line connecting the San Bernardino Valley (Arizona), Rodeo and Animas Quaternary basalt centers. Geophysical and geochemical anomalies in underground waters of the Animas Valley follow this northeasterly trend and focus on the McCants Ranch, site of the geothermal greenhouses. The fluorine-rich waters of the Lightning Dock KGRA seems to be relics of formerly widespread hot springs on both sides of the Animas Valley. Their sites are now indicated by veins of fluorite and/or manganese oxides, some of which grade into travertine or banded calcite (Elston et al., 1983). **2.2**

124.8 MP50. Carbonate Hill mine at 9:00 on east slope of Peloncillo Mtns near northern edge of Cretaceous rocks. The Peloncillo Mtns north of there are composed of Upper Cretaceous to Oligocene volcanic rocks.

Main activity at the mine was 1924–1930 when lead-zinc-silver ore was extracted. The principal ore body contained argentiferous galena and sphalerite replacing Cretaceous limestone adjacent to an andesite dike that was intruded along a northwest-trending fault. **1.0**

125.8 MP51. Steins Pass at 9:30, Doubtful Canyon at 10:00. Highway now on Animas Playa deposits (Fig. 3:131.2). The Alkali Flats (elev. 1265 m) near I-10 are remnants of Lake Animas, which was 27 km long and 6–13 km wide during the Pleistocene. Schwennesen (1918) divided the valley fill into four types: (1) stream and sheetwash alluvial fans, (2) lacustrine deposits, (3) eolian deposits and (4) interbedded basalt. The valley fill is generally correlated with Pliocene and Pleistocene Gila Cgl. **5.4**

131.2 Cattleguard. **Slow bear right** and head east on I-10. **1.1**

132.3 Lee Peak at 12:30, North Pyramid Peak at 2:00. **2.0**

134.3 MP14. Highway rises gradually to Pleistocene beach ridge of former Lake Animas (11:00 to 1:00) exposed in roadcut on right. **1.5**

135.8 Exit 15; Gary. Abandoned mining settlement and spur siding on the SP RR. Outcrop hillocks on both sides of the highway are tuffs and basaltic andesite at northwest edge of Pyramid Mtns. **0.7**

FIGURE 3:131.2. View northwest across South Animas Playa and I-10 to Peloncillo Mtns.

136.5 Roadcuts in manganese-stained Paleocene rhyolite (Thorman and Drewes, 1978). **1.7**

138.2 Approximately here I-10 crosses the old Butterfield Overland Trail. From the high saddle at 2:00 south of Wildcat Hill, the trail emerged from the northern Pyramids, passed between the hills at 8:30 onto North Alkali Flat and struck for Doubtful Canyon at 7:00, landmarked on the south by conical-shaped Steins Peak. **0.4**

138.6 "L" Mountain at 9:00 is composed mostly of Oligocene andesite; some rhyolitic tuff caps the western end. Lee Peak at 3:00 is Upper Cretaceous andesite (Thorman and Drewes, 1978). Note excellent example of an igneous dike wall extending from eastern base of Lee Peak. Roadcuts ahead in Pleistocene pediment gravels. **1.7**

140.3 MP20. Highway curves right. Big Burro Mtns from 10:00 to 12:00. Note extensive development of alluvial fans along the base of the range extending southward toward Lordsburg Draw. **0.8**

141.1 Exit 20; Lordsburg: founded 1880. Population 3,346. Elevation 1294 m. In 1872 confidence men "salted" the slopes of Lee Peak with African and Brazilian diamonds. The resultant sale of stock became known as the Diamond Swindle (Clemons et al., 1980). The ghost town of Shakespeare (previously named Ralston), once a mining center, is 3 km south. A post office was established

there in 1879 but was discontinued Dec. 8, 1885. **0.4**

141.5 Roadcut on right exposes altered volcanic rocks. **0.8**

142.3 MP22. Shakespeare behind low hills at 3:00. Banner mine in distance at 3:15. **0.4**

142.7 Exit 22. Junction of US-70 to Phoenix and NM-90 to Silver City, main business district. Lordsburg is the seat of Hidalgo Co. and is the center of farming, ranching, mining and railroad activities. The town was named after Delbert Lord, chief engineer on the SP RR during construction of the main line. **1.0**

143.7 Weigh station on right. **0.6**

144.3 MP24. Good view of broad bajada at south end of Big Burro Mtns (Fig. 3:144.3) from 9:00 to 12:00. **0.3**

144.6 Exit 24. Small vineyard on right just ahead. **2.2**

146.8 Lordsburg Draw. For the next 3.3 mi the highway crosses the southeastern arm of ancient Lake Animas that once extended around the north end of the Pyramid range. **2.5**

149.3 MP29. Exit 29 for El Paso Natural Gas Company turbine plant on left. **0.5**

149.8 Eastern arm of Lake Animas forms elongate valley on the right. Little Hatchet Mtns at 2:00. Low, rounded hills in the foreground are the Coyote Hills. **0.5**

150.3 MP30. The southern Big Burro Mtns are predominantly Precambrian granite and gneissic granite. These rocks contain 32–55% microcline, 35–65% oligoclase, 25–38% quartz, 1–3% biotite and accessory apatite, sphene, zircon and iron oxides. Samples have yielded Rb-Sr age of 1270 my and K-Ar age of 1550 my. Locally the granite is seen intruding gneisses and amphibolite (Hedlund, 1978b). **4.0**

154.3 MP34. Muir exit at Grant Co. line ahead. This exit provides access to the Blue Teal vineyard and tasting room. The place name honors a pioneer ranching family. It was an old flagstop on the SP RR. Note wind-blown sand that accumulates around the base of desert vegetation providing a hummocky appearance in some areas. Much of southwestern New Mexico lies within the Sonoran Life Zone where flora consists primarily of mesquite, creosote bush, grama and bunch grasses, and various cacti studded in localized forests of yucca. In this great sea of alluvium, most of the bolson soils are derived from the surrounding block uplifts and are deposited by arroyos, sheet wash, stream pondings and discharge by ephemeral channels. **3.0**

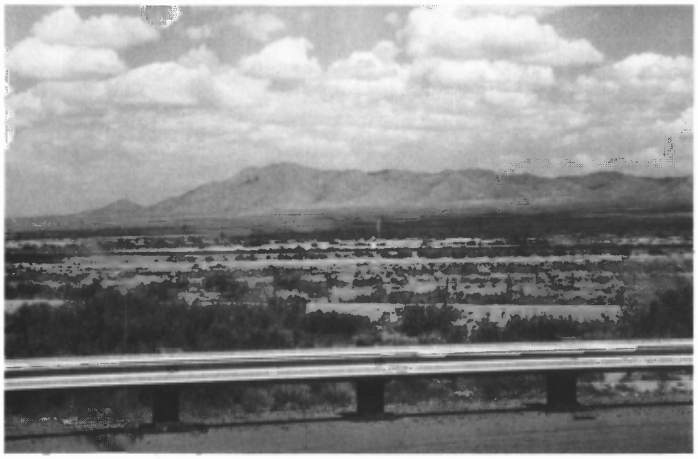

FIGURE 3:144.3. Southern end of Big Burro Mtns.

157.3 MP37. Low ridges in foreground at 2:30 are Brockman Hills. **2.0**

159.3 MP39. Cedar Mtn Range at 1:00; Sierra Alta (in Mexico) at 1:30; Apache Hills at 2:00. **2.0**

161.3 MP41. Soldiers Farewell Hill at 9:00. **1.0**

162.3 MP42. Separ, Exit 42 just ahead. Abandoned railroad construction camp on the Southern Pacific. The name is a corruption of the word "cepas," from the Spanish, meaning "tree stump." Post office was established in 1882, discontinued 1960. Gravel roads provide access to southeastern part of Big Burro Mtns.

In this approximate locale, extending from northeast to southwest, crossed the old Janos trade route. Established in the early 1800s with the discovery of copper at Santa Rita, the trail bore heavy traffic for trade purposes for the attractive stone in the northern reaches of Chihuahua and Sonora. At the time of the U.S. acquisition in 1846, it was the only known route in extreme southwestern New Mexico, and the military relied heavily on its location. Portions of the old road later became known as "Cooke's Wagon Road," when Lt. Col. Philip St. George Cooke led the Mormon Batallion over it to California in the winter of 1846–47 (Clemons et al., 1980). **1.2**

163.5 Big Hatchet Peak on distant skyline at 2:00. Soldier's Farewell Hill (1882 m) at 8:30 is a remnant of an Oligocene rhyodacite flow (Hedlund, 1978a). From the summit of this hill, according to one early-day legend, a group of seven soldiers signaled by mirror to the station on Cooke's Peak that they were going to attack hostile Indians blocking access to a water supply—a spring at the bottom of the hill. All the soldiers were killed. A Butterfield Mail station lay about 3.2 km west of the hill as the trail passed between Soldier's Farewell Hill and Bessie Rhoads Mtn. These stations spaced along the way, either as relay stations for men and horses, mail distribution points or rest stops for passengers, frequently left much to be desired. The food that was sometimes available at the stations was generally rated from "plain" to "terrible." Salt pork, beans, hardtack or soggy biscuits and a "miserable apology for coffee" were common fare. Many travelers carried their own food rather than take any chances on food served along the way. In rare instances, particularly at the important waystations where time was allowed for more leisurely rest stops, good food or lodging was available. Most stations were designed for the benefit of the drivers and livestock—not for the passengers (Clemons et al., 1980). Light-colored peaks at 8:30 are rhyolite domes; Bessie Rhoads Mtn (1754 m) is the closest one to Soldier's Farewell Hill. **1.7**

165.2 Highway curves left. **0.5**

165.7 Railroad overpass. This line was built by Phelps Dodge for ore shipments to its Playas smelter that began operation in June 1976. **2.6**

168.3 MP48. Whitecap Hill at 10:00. **1.8**

170.1 Exit 49. NM-81 south to Hachita. Whitecap Hill beyond windmill at 9:00 is composed of complexly faulted El Paso and Montoya Fms. **1.7**

171.8 Continental Divide (1398 m). Grandmother Mtns at 10:30, Victorio Mtns at 12:45. **1.5**

173.3 MP53. Rest area on right ahead. Victorio Mtns at 12:30,

Tres Hermanas Mtns at 2:00 and Cedar Mtn Range at 3:00. Grandmother Mtns at 10:00 are Oligocene(?) latite of Clabber Top Hill. The latite intruded probable Ringbone or Lobo Fm sedimentary rocks that are locally exposed at the base of the southern slopes (Thorman and Drewes, 1979a). Bajada around the mountains is underlain by younger Gila Cgl. **1.5**

174.8 Entering Luna County. **1.3**

176.1 Exit 55. Quincy was once a station on the SP RR. **3.2**

179.3 MP59. Small roadcuts on right are in colluvium of Victorio Mtns. Profile includes local patches of andesite. Mines in the southeastern part of the Victorio Mtns at 2:00 produced lead, zinc, silver and gold during a high period of activity between 1880 and 1886. A post office was established at Chance City there in 1885 but was discontinued in 1886. The last significant ore shipment was made in 1947. Clabber Top Hill at 10:45. **0.3**

179.6 Small roadcuts in andesite. **1.7**

181.3 MP61. Roadside rest area on left serving westbound lanes of I-10. This particular rest area was one of the first installations included in the National Program of Highway Beautification. The site was chosen purposely in a yucca forest. During the late spring months when the state flower (*Yucca elata*) blooms, the site is visited to view and photograph the floral displays. **1.7**

183.0 Exit 62. Gage formerly was a water stop on the SP RR. Settled in 1880 and named for General Thomas Gage. Post office was discontinued Feb. 26, 1965.

Quarry on right side of hill at 3:00 is where El Paso ls was excavated for construction material for this portion of I-10. **3.4**

186.4 Cooke's Peak at 10:30; Snake Hills at 1:30 in front of Florida Mtns. **2.2**

188.6 Exit 68 for NM-418; an alternate farm route to Deming. El Paso Natural Gas compressor station at 9:00. **0.2**

188.8 Entering agricultural district of the western portion of the Mimbres basin. Principal crops are sorghum and cotton. As early as 1909, the first irrigated farms were started in Luna Co. Today there are more than 300 farms in the Mimbres basin with approximately 40,000 acres under cultivation. Each year, about 25,000 bales of fine-grade cotton are ginned from the area. Vineyards were introduced in the early 1980s. Water is pumped from depths of six to 16 m and has declined with increased pumpage. **0.5**

FIGURE 3:193.3. Red Mtn on left with Florida Mtns in distance on right.

189.3 MP69. Black Mtn (1636 m), at 10:00, is capped by upper Tertiary basaltic andesite. Seville-Trident's No. 1 state well is located just west of Black Mtn (see Second-Day Road Log). **4.0**

193.3 MP73. Red Mtn at 2:30 (Fig. 3:193.3). Seville-Trident's No. 1 Hurt Ranch exploration well was drilled near the northern base of the mountain in 1983, TD was 2355 m (see Second-Day Road Log and Clemons, 1986a). **5.0**

198.3 MP78. Little Florida Mtns 1:00–1:30, Florida Mtns 1:30–2:30. **3.0**

201.3 MP81. Exit 81, Deming.

End of Third-Day Road Log.