Supplemental road log: From junction of US-380 and NM-37 to Capitan

Steven M. Cather and Wolfgang E. Elston

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SUPPLEMENTAL ROAD LOG, FROM JUNCTION OF US-380 AND NM-37 TO CAPITAN

STEVEN M. CATHER and WOLFGANG E. ELSTON

Assembly point: Junction of US-380 and NM-37.
Distance: 12.1 miles
Stops: 2

SUMMARY

The road log route follows US-380 eastward through the northern part of the Sierra Blanca basin past good exposures of Upper Cretaceous strata, Paleogene siliciclastic and volcaniclastic deposits, and Tertiary intrusive rocks. The first stop is to examine a pebbly sandstone of the Sanders Canyon Formation, formerly regarded as part of the Cub Mountain Formation. The second stop allows examination of numerous Tertiary intrusions within the Mesaverde Group.

This log draws many data from Ulvog and Thompson (1964) and Osburn and Arkell (1986). Thin-section descriptions are by S. M. Cather.

Mileage

0.0 **Junction** of US-380 and NM-37. **Proceed east** on US-380. **0.4**

0.4 Milepost 74. Bridge crosses Nogal Arroyo. Carrizo Mountain (Fig. S-1.1) at 8:30 exposes a Tertiary laccolith composed of syenite porphyry (Kelley, 1971; Pertl and Cepeda, 1991, this guidebook). Vera Cruz Mountain at 10:00 consists of deformed and intruded Upper Cretaceous Mesaverde Group (Kelley, 1971). **0.9**

1.3 Church Mountain at 2:30 exposes Tertiary Sierra Blanca Volcanics and intrusives. **0.4**

1.7 Dirt road across private property on left leads to abandoned gold mine on Vera Cruz Mountain at 9:30. Tailings are visible about halfway up the mountain. **0.5**

2.2 Sandstone and mudstone of Mesaverde Group exposed in roadcuts (Fig. S-1.2). **0.2**

FIGURE S-1.1. View northwest of Carrizo Mountain, composed of a Tertiary syenite-porphyry laccolith.

FIGURE S-1.2. Roadcut exposure of thin sandstones and carbonaceous mudstones of Mesaverde Group.

2.4 Milepost 76. **0.1**

2.5 Mesaverde Group exposed in roadcuts. **0.3**

2.8 Faulted and intruded sandstone and mudstone of Mesaverde Group exposed in left roadcut. **0.2**

3.0 Mesaverde Group exposed in left roadcut. **0.2**

3.2 Entering Lincoln National Forest. **0.1**

3.3 Mesaverde Group sandstone intruded by porphyritic dikes in old roadcut on left. **0.1**

3.4 Smokey Bear story on sign to right. **0.1**

3.5 Sandstone and mudstone of Mesaverde Group and porphyritic sill in left roadcut. **0.4**

3.9 **STOP 1. Check traffic and park on left side of road** to examine exposure of Sanders Canyon Formation (formerly upper part of Cub Mountain Formation; see Cather, 1991, this guidebook) and Tertiary dikes in old roadcut (Fig. S-1.3). The pebbly sandstone in this outcrop is

FIGURE S-1.3. Pebbly sandstone of Sanders Canyon Formation and Tertiary dikes at Stop 1. Hammer (arrow) is scale.

somewhat anomalous because it is yellowish-gray and contains quartzite pebbles, characteristics typical of the lower Cub Mountain Formation. The assignment of these rocks to the Sanders Canyon Formation is based on the presence in thin section of about 50% volcanogenic detritus (plagioclase, biotite and vitric fragments), which occurs only in minor amounts in the Cub Mountain Formation (Cather, 1991, this guidebook). The yellowish hue of these deposits may be due to alteration related to intrusion of the mafic dikes. Crossbedding and pebble imbrications indicate that paleoflow was northeastward (mean = N55°E). **Continue east on US-380. 0.1**

4.0 Crossing down-to-west fault marked by dike on left. **0.1**

4.1 Sandstone and mudstone of Crevasse Canyon Formation and Tertiary intrusives in roadcut on left. Sandstone at west end of this roadcut (Fig. S-1.4) was assigned to basal Cub Mountain Formation by Ulvog and Thompson (1964) and Osburn and Arkell (1986). In thin section, this sandstone is dominated by non-volcanic detritus (quartz, chert, orthoclase, granite/gneiss rock fragments and muscovite) and contains only minor amounts of plagioclase. Another thin section, cut from a sandstone about 50 m to the east in what is clearly the Crevasse Canyon Formation, shows a similar detrital composition. The sandstone at the west end of the roadcut is herein regarded as part of the Crevasse Canyon Formation because it does not contain pebbles or display the basal disconformity typical of the lower Cub Mountain Formation throughout the Sierra Blanca basin.

A thin section from a Tertiary sill in this roadcut shows porphyritic texture with phenocrysts of plagioclase (≤3 mm), clinopyroxene, opaque minerals and amphibole (?; now replaced by clay) in a felty groundmass dominated by plagioclase. **0.4**

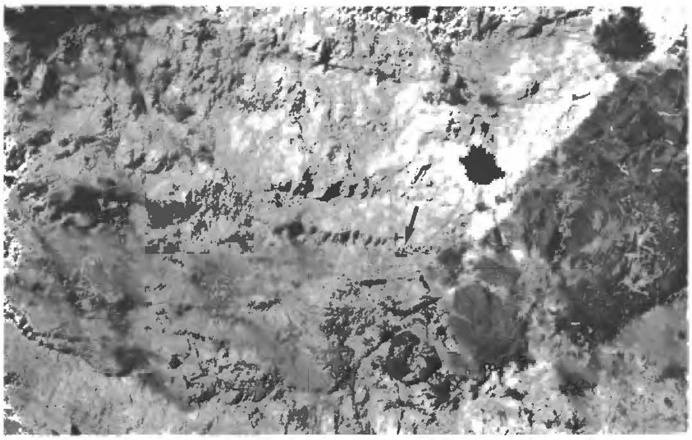


FIGURE S-1.4. Hammer (arrow) marks placement of contact between Crevasse Canyon Formation and overlying Cub Mountain Formation according to previous workers (Ulvog and Thompson, 1964; Osbum and Arkell, 1986) at mile 4.1. Sandstone petrology, lack of pebbles and lack of evidence for a basal disconformity, however, argue for inclusion of all of these rocks in the Crevasse Canyon Formation. Note dike on right.

4.5 Exposures of intruded and deformed Crevasse Canyon Formation in left and right roadcuts next 1.2 mi. Extensional strain must have been significant to allow such abundant dike intrusion. **0.8**

5.3 Old roadcuts expose Crevasse Canyon Formation and Tertiary intrusive rocks across valley to left. **0.3**

5.6 **STOP 2. Park on shoulder** to examine Tertiary intrusives in roadcuts. **Continue east on US-380. 0.1**

THE CAPITAN DIKE-AND-SILL SWARM (LINCOLN COUNTY, NEW MEXICO) REVISITED

Wolfgang E. Elston

Department of Geology, University of New Mexico, Albuquerque, New Mexico 87131-1116

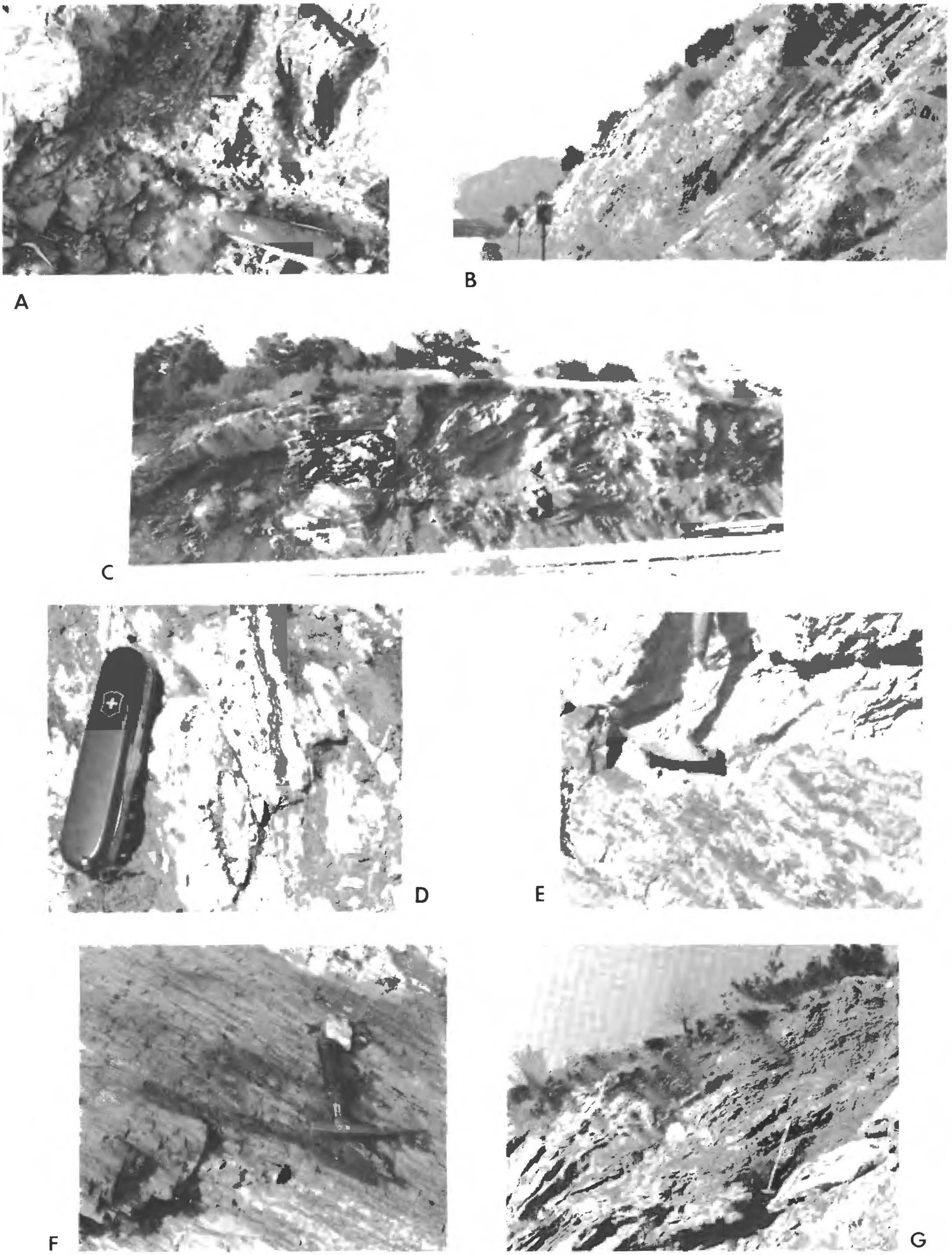
In the summer of 1956, the Director of the State Bureau of Mines and Mineral Resources, Eugene Callaghan, assigned me to assist John E. Allen in finishing his geological map of the Capitan 15-min quadrangle. John was about to leave New Mexico Tech for (literally) greener pastures at Portland State University in Oregon. After he had departed, I spent the rest of the field season unraveling the sequence of Tertiary dikes and sills that were magnificently exposed in roadcuts on old US-380, between Carrizozo and Capitan. Since then, many of the cuts I examined were modified, some beyond recognition, when the highway was widened. However, new cuts were created when the highway was straightened, among them those at Stop 2.

The dike swarm trends north-northeast and can be traced for about 50 km, from the vicinity of Sierra Blanca to the Jicarilla Mountains. The most conspicuous mafic dikes, about 10 m wide and up to 5 km long, are covered with pictographs and petroglyphs. The densest concentration is near Indian Divide, the location of Stop 2. Along US-380, a sequence of seven rock types was established from crosscutting relationships and chilled borders (Fig. S-1.5A): (1) labradorite-olivine diabase porphyry, with conspicuous (to 1.0 cm) labradorite phenocrysts, (2) olivine diabase porphyry, (3) diabase, (4) hornblende-biotite diabase, (5) rhyolite, (6) latite and (7) phonolite. It is uncertain whether this sequence can be applied to the entire length of the swarm.

The evidence for this succession, and petrographic descriptions, were published in the previous NMGS Ruidoso Guidebook (Elston and Snider, 1964). Rock identifications were by microscopy and must be regarded as tentative; chemical analyses were beyond our means in the late 1950s and early 1960s. John Allen never published his Capitan map and, as far as I know, these dikes have not been analyzed to this day.

The roadcuts at Stop 2 illustrate several characteristics of the dikes. The term *dike* is used loosely. At the east end of the roadcut, on the north side of the highway, the intruded Cretaceous sedimentary rocks dip from 43° to 80°SE; concordant tabular intrusions are steeply dipping sills rather than dikes (Fig. S-1.5B). Where dips of sedimentary rocks are more gentle, the same intrusions would be termed dikes. In general, mafic intrusions tend to have steep dips, regardless of the dip of intruded rocks. Rhyolitic bodies tend to be sills, regardless of dip, emplaced

FIGURE S-1.5. Characteristics of dike-and-sill swarm between Carrizozo and Capitan. A, Criteria for determining relative ages of dikes. Knife is directly below the chilled margin of a coarsely porphyritic Type-1 dike (labradorite-olivine diabase porphyry), in contact with Cretaceous sandstone, mile 4.9. On the left side of the photo, the Type-1 dike is transected by a latite dike (Type 6). Knife is 9 cm long. B, Mafic sills intruded into steeply dipping sedimentary rocks of the Mesaverde Group, Stop 2. C, Roadcut at mile 4.9. Rhyolite sill (left) and mafic dikes. A sketch of the same roadcut was shown in Elston and Snider (1964, fig. 2c) but subsequent widening of the highway has modified it. D, Minor flow fold in rhyolite sill, Stop 2. E, Slickensides on top of rhyolite sill, Stop 2. F, Striations on surfaces of flow bands in a rhyolite sill, mile 4.9. G, Deformation of Cretaceous sedimentary rocks next to a rhyolite sill, Stop 2. A small fault with drag folds extends from the hammer head to the upper left. A sandstone boudin lies to the right of the hammer head. Smooth surface on massive rock to the right is the slickensided top of a rhyolite sill. Hammer is 90 cm long.


A
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along zones of incompetent shale (Fig. S-1.5C). Their high viscosity is demonstrated by intricate folds in flow bands (Fig. S-1.5D). Slickensides appear on the upper surface of a rhyolite sill, in contact with Cretaceous shale (Fig. S-1.5E). They should not be confused with striations on the surfaces of flow bands, which indicate the lineation of flow movement (Fig. S-1.5F). Shale pushed aside by intrusion of rhyolite is contorted by minor folds and by folds and faults; sandstone bands are kneaded into boudins (Fig. S-1.5G). On the south side of the highway, spheroidal weathering is conspicuous in mafic dikes.

The association of rhyolite and rare phonolite is unusual. In our 1964 paper, we concluded that rhyolite was coeval with, and related to, the large granitic plutons of Carrizo, Capitan and Patos Mountains to the north. All other dikes were interpreted as a separate and unrelated suite, with alkalic affinities. Today I would use the term *bimodal assemblage*. Many of the rocks show evidence of late- to post-magmatic alkalic overprints. Toward the margins of certain mafic dikes, plagioclase becomes progressively more sodic, from labradorite to oligoclase. Between the core and the roof of the granitic Carrizo Mountain pluton, orthoclase progressively replaces plagioclase. The Capitan dike-and-sill swarm seems to belong to a regional belt of alkalic rocks on the eastern fringe of the Cordilleran orogen, from the Highwood province of Montana, via the Spanish Peaks of Colorado, to the eastern part of Trans-Pecos Texas, and south into Mexico.

5.7 Indian Divide. **0.1**

5.8 Crossing Indian Divide fault zone which juxtaposes the Crevasse Canyon Formation against the Sierra Blanca Volcanics on the east. The fault is down-to-the-east, with a displacement that is at least equivalent to the combined thickness of the Cub Mountain and Sanders Canyon Formations (about 910 m in the western part of the Sierra Blanca basin; Cather, 1991, this guidebook). Numerous porphyritic intrusions are present along the fault zone. **0.2**

6.0 Ranchman's Camp Meeting turnoff on right. Roadcut on left exposes coarse debris-flow deposits and subordinate fluvial deposits of Tertiary Sierra Blanca Volcanics (Fig. S-1.6). Cobbles and boulders are common, and a single clast about 1 m long is exposed. **0.2**

6.2 Exposure of highly intruded Sierra Blanca Volcanics in left roadcut. Note old railroad grade on right. **0.3**

6.5 Debris-flow deposits of Tertiary Sierra Blanca Volcanics in left roadcut. **0.2**

6.7 Dirt road on left. South Fork of Salado Creek parallels US-380 on right. **0.1**

6.8 Volcaniclastic rocks in left roadcut may record interfingering of locally derived, conglomeratic Sierra Blanca Volcanics with subjacent, distally derived, volcaniclastic siltstones and mudstones of Sanders Canyon Formation. A similar sequence is exposed at mile 7.9 in Part Three of the Second-Day Road Log. A thick, greenish-yellow dike is also present in this roadcut. Regionally, the basal contact of the Sierra Blanca Volcanics appears to be conformable and gradational with the Sanders Canyon Formation, except in the southeast part of the Sierra Blanca basin, where the Sierra Blanca Volcanics overlie Upper Cretaceous strata with disconformity or angular unconformity (Thompson, 1966; Kelley, 1971; Moore et al., 1988). **0.2**

7.0 Tertiary intrusions in sandstone and mudstone of Sanders Canyon Formation in left roadcuts, next 0.2 mi. **0.4**

7.4 Roadcuts on left next 0.2 mi exhibit numerous dikes and faults and contain the gradational contact between gray to purple volcaniclastic deposits of Sanders Canyon Formation (to west) and red mudstone and yellow quartzose sandstone of subjacent Cub Mountain Formation. **0.4**

FIGURE S-1.6. Volcanic cobbles and boulders in debris-flow deposits of Sierra Blanca Volcanics at mile 6.0.

FIGURE S-1.7. Official Scenic Historical Marker west of Capitan, New Mexico.

7.8 Sandstone and mudstone of Eocene Cub Mountain Formation and intrusive rocks in left roadcut. **0.1**
7.9 Road curves to right over bridge across Salado Creek. **0.2**
8.1 Roadcut on right exposes sandstone and mudstone of Cub Mountain Formation and Tertiary dikes. **0.4**
8.5 Mudstone of Cub Mountain Formation intruded by west-dipping rhyolite sill on left. **0.2**
8.7 Mudstone and sandstone of Cub Mountain Formation intruded by dikes in roadcuts on left, next 0.4 mi. **0.5**
9.2 Crossing approximate trace of down-to-the-west fault that juxtaposes Cub Mountain Formation with Crevasse Canyon Formation. **0.1**
9.3 Sandstone and mudstone of Upper Cretaceous Crevasse Canyon Formation and dikes on left, next 0.8 mi. **0.2**
9.5 Milepost 83. **0.4**
9.9 Sandstone and mudstone of Crevasse Canyon Formation and Tertiary dike on right. **0.3**
10.2 Roadcut on right and ridge at 9:00 expose Gallup Sandstone. The subjacent Mancos Shale here contains Coniacian fossils (the pelecypods *Inoceramus erectus, Ostrea anomioides* and *Crassostrea soleniscus*). **0.1**
10.3 Official Scenic Historic Marker: "Capitan (population 762, elevation 6,350 ft)" (Fig. S-1.7). **0.7**
11.0 Erosional rubble of Tertiary dike on left. **0.4**
11.4 Entering Capitan. **0.6**
12.0 Smokey Bear Museum and State Park on left. See mini-paper by McLemore in Second-Day Road Log. **0.1**
12.1 Junction with NM-48 on right.

End of Supplemental Road Log.

Jeff Grambling at Day 2, Stop 2 of the 1990 NMGS Field Conference summarizing Proterozoic geology below Eagle Nest Dam. Gretchen Hoffman (in cap), partly obscured by flagwoman Chris White, holds one of Jeff's posters (Russ Jentgen holds the other) but can only listen, not see it; coal is not too common in the Precambrian anyway. Illustration by Louann Jordan of Santa Fe, 1990.