GEOLOGICAL SOCIETY OF AMERICA
ROCKY MOUNTAIN-SOUTH CENTRAL SECTION MEETING, ALBUQUERQUE, NM
PRE-MEETINNG FIELD TRIP: STRATIGRAPHY AND TECTONIC DEVELOPMENT OF THE ALBUQUERQUE BASIN, CENTRAL RIO GRANDE RIFT

FIRST DAY ROAD LOG, APRIL 27, 2001
SANTO DOMINGO SUB-BASIN: HAGAN EMBAYMENT AND NORTHERN FLANK OF THE SANDIA MOUNTAINS

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The following road log through the Santo Domingo sub-basin has been summarized and modified from New Mexico Geological Society Guidebook 50 by Pazzaglia et al. (1999a) and Hawley and Galusha (1978). Road-log mileage not checked for accuracy.

Mileage	Description
0.0	Load vehicles at Sheraton Old Town hotel. Turn right (North) on Rio Grande Blvd. **0.3**
0.3	Cross under 1-40 overpass. **1.4**
1.7	Turn right (east) onto Candelaria Blvd. **1.8**
3.5	Cross drain at corner of 2nd Street and Candelaria. **0.2**
3.7	Cross Railroad tracks. **0.2**
3.9	Cross Edith Blvd. and begin ascending Holocene-latest Pleistocene valley border fans derived from the Sandia Mts. These alluvial deposits grade over, and interfinger with, floodplain and old channel deposits of the Rio Grande. **0.7**
4.6	Turn left onto North Frontage Rd. (Pan American Highway). Keep to your left and merge onto I-25 northbound to Santa Fe. The basalt flows and splatter cones to your left across the Rio Grande Valley are the Albuquerque volcanoes, which have been dated ($^{238}U/^{230}Th$ method) at 156±29 ka (Peate et al., 1996). These basalt flows interfinger with the upper part of am ancestral Rio Grande fluvial deposit of the Los Duranes Fm, which was originally defined by Lambert (1968). **1.6**
6.2	Pass under Montaño Blvd. (exit 228). **0.6**
6.8	Gravel quarries on your left are excavating aggregate from the Edith Fm, an extensive and important marker unit originally defined by Lambert (1968) for exposures along Edith Blvd. Many of the original exposures along Edith Blvd. are being covered or obscured by urban development. The Edith Fm locally yields fossil mammals of Rancholabrean age (~400-10 ka), including mammoth, bison, horse, and ground sloth (Lucas et al., 1988). On your left, north to exit 230 are a number of industrial/commercial tracts constructed on reclaimed aggregate quarries in the Edith Fm. On your right is the rugged western escarpment of the Sandia Mts. Rincon Ridge is between 1:00-2:00. Well-sorted axial-fluvial sand and gravel of the ancestral Rio Grande underlie locally derived piedmont deposits of the rift-bounding Sandia Mts. to the east. These fluvial deposits constitute the narrow axial-fluvial lithofacies of the ancestral Rio Grande, which represent some of the best aquifer units of the Santa Fe Group. Deposits of the ancestral Rio Grande basin fill are mostly between Eubank and Edith Blvds. **1.8**

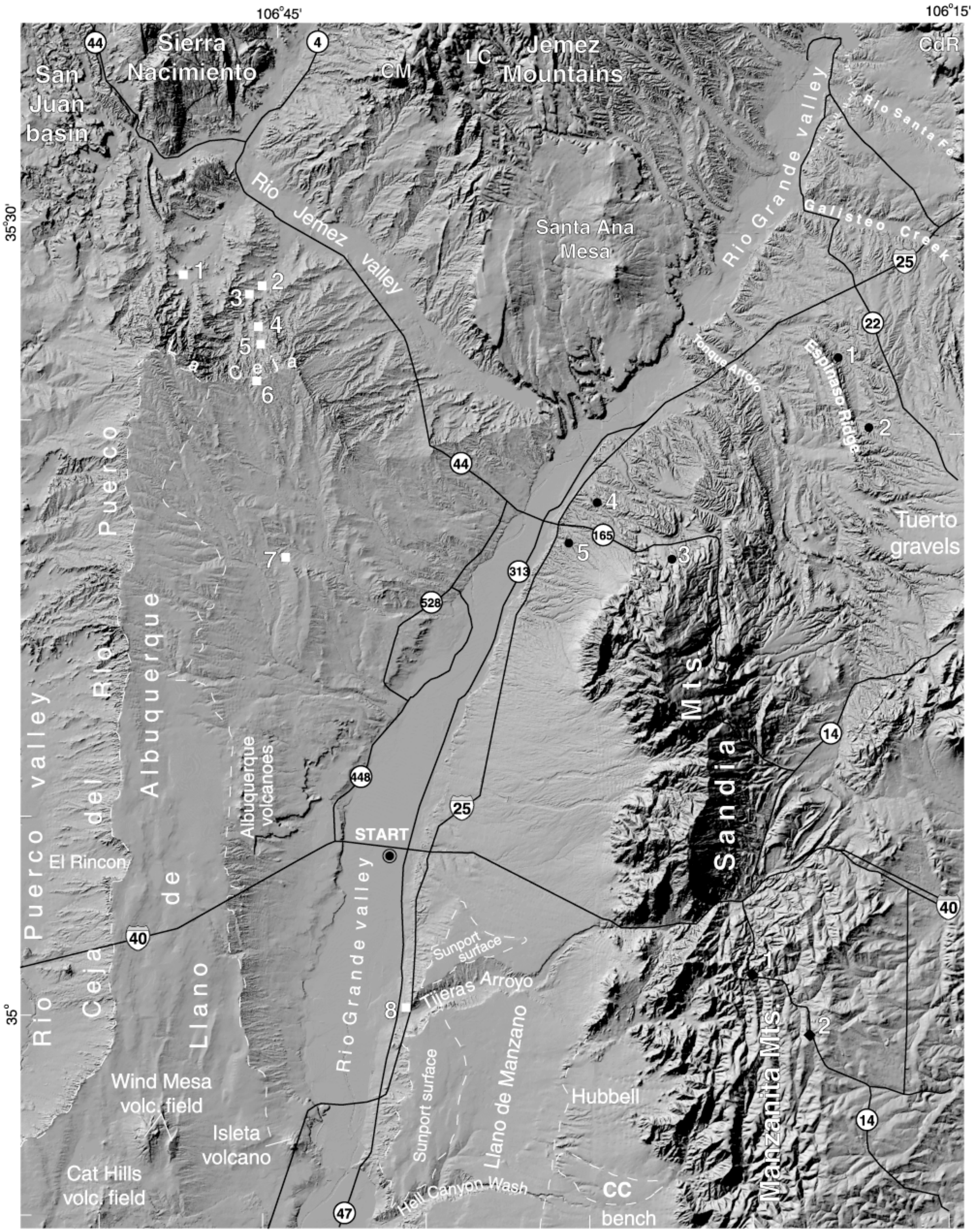

Figure 1-1. Shaded-relief map of the Albuquerque area, illustrating the locations of stops for day 1 (black circles), and day 2 (white squares). Base prepared by S.D. Connell for Pazzaglia et al. (1999b).

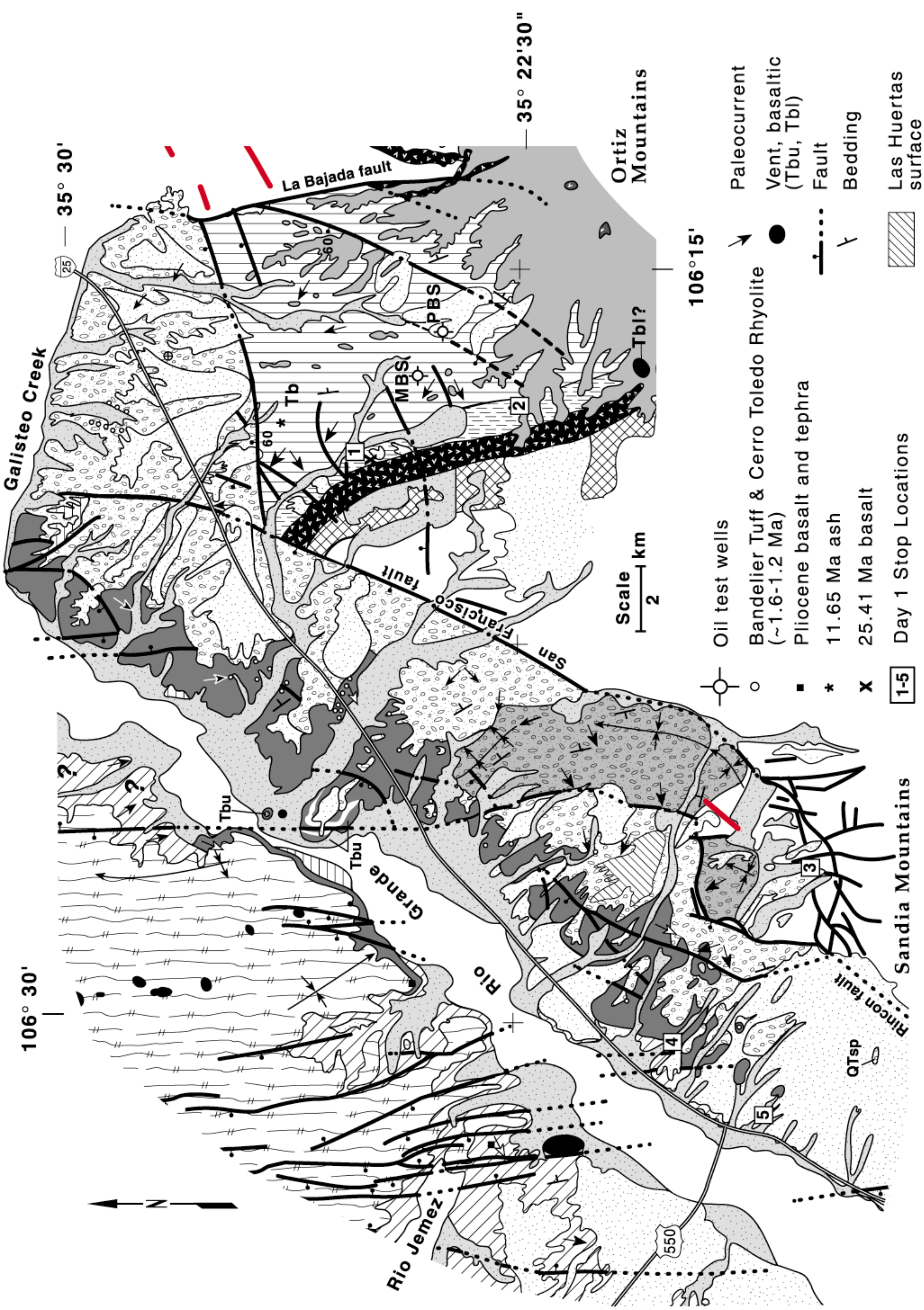
35° 30'
35° 22'30"
106° 30'
106°15'
La Bajada fault
Ortiz Mountains
Galisteo Creek
San Francisco fault
Rio Grande
Rio Jemez
Sandia Mountains
Rincon fault
Tbu
Tb
PBS
MBS
Tbl?
QTsp
60
25
550
N
Scale
2 km
Oil test wells
Bandelier Tuff & Cerro Toledo Rhyolite (~1.6-1.2 Ma)
Pliocene basalt and tephra
11.65 Ma ash
25.41 Ma basalt
1-5 Day 1 Stop Locations
Paleocurrent
Vent, basaltic (Tbu, Tbl)
Fault
Bedding
Las Huertas surface

Figure 1-2. Explanation and simplified geologic map of the southeastern Santo Domingo sub-basin (previous page), illustrating locations of Day 1 stop localities (compiled from Cather and Connell, 1998; Cather et al., 2000; Connell, 1998, Connell et al., 1995; unpublished mapping). Bandelier Tuff and Cerro Toledo Rhyolite are found as fallout ash and lapilli and, more commonly, as fluvially recycled pumice pebbles and cobbles.

8.6 San Antonio Drive overpass (exit 231). Latest Pleistocene and Holocene piedmont deposits derived from Sandia Mts. form valley border fans that overlie the Edith Fm. Many of the larger buildings immediately east and west of I-25 in this area have been affected by structural damage attributed to hydrocollapsing soils associated with these young silty sands, which are typically less dense than the older piedmont deposits, have higher blow counts during percussion drilling, and consolidate when wetted. These soils are susceptible to compaction when they receive large amounts of moisture, typically associated with landscaping irrigation or leaking water or sewer pipes. **1.0**

9.6 Paseo del Norte Blvd. overpass (exit 232). **1.1**

10.7 To the left are computer chip production facilities run by Phillips and Sumitomo Sitix, which have cooperated with the City of Albuquerque on a joint water reclamation project to recycle water for use on the grounds of Balloon Fiesta Park. **0.8**

11.5 Southern boundary of Sandia Pueblo. **0.1**

11.6 Milepost 234. Tramway Blvd./Roy Avenue underpass. Sierra Nacimiento at 10:00, Jemez Mts. and basalts at Santa Ana Mesa (a.k.a. San Felipe Mesa) at 11:00, Sandia Mts. at 3:00. The cliffs consists of the 1.44 Ga Sandia granite, which intruded into the 1.7 Ga Rincon Ridge metamorphic complex. These crystalline rocks are nonconformably overlain by the Pennsylvanian Sandia and Madera fms. Late Pleistocene to Holocene valley border deposits are inset against the Edith Fm to the north, but overlie the Edith Fm to the south. The entrenchment of younger alluvium into the Edith Fm is attributed to broad deformation across the northwest-trending Alameda structural zone (Pazzaglia et al., 1999a). Quaternary deformation is interpreted here, primarily because the basal contact (strath) of the Edith Fm decreases in elevation by about 15 m across this inferred structural zone (Connell, 1998) and younger piedmont alluvium is inset against the Edith Fm to the north. To the west are abandoned and reclaimed quarries in the Edith Fm. Current quarry operations are to the north. **2.9**

14.5 Milepost 237. At about 9:00, west of the Rio Grande Valley is Loma Colorada del Abajo, a low hill underlain by Pliocene-aged light gray sandy gravel of the Ceja Mbr, which overlies reddish-brown sediments of the Loma Barbon Mbr (same formation, Pliocene). To your left is an unconformable contact between the Edith Fm and slightly east-tilted reddish-brown strata assigned to the Loma Barbon Mbr. **2.0**

16.5 Milepost 239. Edith Fm overlies east-tilted red sandstone of the Loma Barbon Mbr. **2.7**

19.2 On your right, reddish-brown Loma Barbon Mbr unconformably overlain by rounded quartzite-bearing gravel of the Edith Fm. **0.3**

19.5 Exit 242 to Rio Rancho and Placitas, highways NM-165 and US-550. **0.2**

19.7 Overpass of US-550 and NM-165. **0.8**

20.5 Milepost 243. Centex Gypsum wallboard production plant on the left at 9:00. This plant processes gypsum from local quarries developed in the Jurassic Todilto Fm, some of which is locally mined from exposures along the basin margin. **1.0**

21.5 Milepost 244. Maar of Canjilon (octopus) Hill at 9:00. This volcanic edifice was K/Ar dated at 2.6±0.1 Ma (Kelley and Kudo, 1977). Between 10:00 and 11:00, are the east-tilted and faulted basalts at Santa Ana Mesa. Recent $^{40}Ar/^{39}Ar$ dates along the southeastern margin indicate these flows were emplaced between 2.24-1.77 Ma (W.C. McIntosh, 1997, written commun.; Cather and Connell, 1998). **1.0**

22.5 Milepost 245. Ascending hill underlain by middle to late Pleistocene (post-Santa Fe Group) piedmont deposits overlying Edith Fm. **1.5**

24.0 Las Huertas Creek. **0.3**

24.3 Middle to late Pleistocene piedmont deposits overlying the Edith Fm. **0.4**

24.7 Between 9:00 and 10:00 are interbedded reddish brown sand of the Arroyo Ojito Fm and light-gray sand of the ancestral Rio Grande facies (Sierra Ladrones Fm) beneath the basalt flows at Santa Ana Mesa. **0.7**

25.4 Exit 248. Algodones overpass. **0.4**

25.8 On your left is the Plains Electric generation plant. The hummocky topography flanking the basalt flows at Santa Ana Mesa is formed by Pleistocene landslides that locally cover inset fluvial (fill-terrace) deposits of the ancestral Rio Grande (Cather and Connell, 1998). **0.6**

26.4 Milepost 249. To your left are moderately dipping cliffs of older piedmont deposits of the Santa Fe Group, exposed in Arroyo Maria Chavez. **0.6**

27.0 At 10:00, a basalt flow of the Santa Ana Mesa basalts is cut by the Escala fault, which is a prominent down-to-west fault that begins south at the northern flank of the Sandia Mts., near Placitas. The eastern margin of these basalt flows and vents are exposed on Santa Ana Mesa but descend eastward where they are interbedded with ancestral Rio Grande (fluvial) deposits of the Sierra Ladrones Fm (Fig. 1-3). **1.2**

28.2 On the right is a gravel quarry in the ancestral Rio Grande deposits of the Sierra Ladrones Fm (upper Santa Fe Group). **1.0**

29.2 On the left is a succession of sandy piedmont deposits of the Sierra Ladrones Fm that overlie ancestral Rio Grande deposits (ARG) of the same formation. These piedmont deposits interfinger with fluvial facies to the east. **0.6**

29.8 Exit 252. Overpass to San Felipe Pueblo. Crossing over Tonque Arroyo. **0.7**

Figure 1-3. Photo looking to the north near Milepost 249. Plio-Pleistocene ancestral Rio Grande deposits of the Sierra Ladrones Fm (ARG) interfinger with this Pliocene basalt.

30.5 On your left is a northeast-tilted, white ash bed. Along the south side of Tonque Arroyo, just east of the San Felipe Casino, this ash bed is at the contact between fluvial deposits of the ancestral Rio Grande and overlying piedmont deposits. This ash bed was dated using the $^{40}Ar/^{39}Ar$ method at 1.57±0.06 Ma (W.C. McIntosh, 1998, written commun.) and is chemically similar to the Cerro Toledo Rhyolite (N. Dunbar, 2000, written commun), a series of eruptions between the caldera collapse events of the lower and upper Bandelier Tuff in the Jemez Mts. **0.4**

30.9 To the north between 11:00 and 12:00 is the Cerros del Rio volcanic field, which is on the footwall of the La Bajada fault. Tetilla Peak is at 11:00. **0.8**

31.7 Crossing Arroyo de la Vega de los Tanos (Tanos Arroyo). On your right, Espinaso ridge is held up by upper Eocene and Oligocene volcaniclastic deposits of the Espinaso Fm, which conformably overlies the Eocene Galisteo Fm. The Ortiz Mts., at 3:00, are the source of detritus for the Espinaso Fm at Espinaso Ridge. The northern tip of Espinaso Ridge is cut by the San Francisco fault. This fault is another major down-to-west normal fault that begins at the northern flank of the Sandia Mts., near Placitas. **1.7**

33.4 On your left are the Jemez Mts. Between 9:00 and 10:00, Tent Rocks underlain by late Miocene Peralta Tuff Mbr of the Bearhead Rhyolite. Some of the oldest deposits of the ancestral Rio Grande are recognized in ~6.9 Ma beds of the Peralta Tuff at Tent Rocks (Smith and Kuhle, 1998). The Cerrillos Hills, another Oligocene-age intrusive and volcanic center, related to the Ortiz Mts., is between 10:00 and 1:00. **1.2**

34.6 Leave I-25 at Budaghers exit (exit 257). **0.3**

34.9 Turn right onto Budaghers Blvd. at stop sign at top of offramp. **0.1**

35.0 Make a sharp right onto east frontage road. The cliffs in the quarry to your left contain well cemented sandstone and travertine of the upper Santa Fe Group, on the footwall of the San Francisco fault. **0.4**

35.4 Cross cattleguard, pavement ends at Arroyo Vega Tanos Rd. Proceed on dirt road to the left. **0.4**

35.8 Low hills to the left are topographic scarps of the Budaghers fault. **0.4**

36.2 To your left, note well cemented piedmont pebbly sandstone of the Blackshare Fm. **0.1**

36.3 Cross through cattle gate **and make a sharp left. You must obtain permission from the Ball Ranch prior to passing this gate**, which is normally locked. **0.2**

36.5 Crossing Tanos Arroyo. **1.2**

37.7 Pass through cattle gate. **0.1**

37.8 Around you is mudstone and sandstone of the Tanos Fm, which is commonly overlain by gravelly Quaternary alluvium. **0.9**

38.7 **STOP 1:** Oligocene through middle Miocene deposits of the Lower Santa Fe Group at Arroyo de la Vega de los Tanos (Tanos Arroyo). *San Felipe Pueblo NE 7.5' quadrangle, GPS: NAD 83, UTM Zone 013 S, N: 3,920,012 m; E: 380,479 m.*

The purposes of this stop are to: 1) summarize the geology of Paleogene pre-rift rocks of the Espinaso, Galisteo, and Diamond Tail fms; 2) discuss the Oligocene hypabyssal intrusive and volcanic rocks of the Ortiz porphyry belt; 3) examine the oldest, dated, exposed section of lower Santa Fe Group in the Hagan embayment.

The Hagan embayment is a structural re-entrant formed between the San Francisco and La Bajada faults. The embayment marks the eastern boundary of the rift and contains a well exposed succession sedimentary rocks, encompassing much of the Pennsylvanian-Pleistocene geologic record. The discussion of pre-Espinaso Fm rocks is summarized from Pazzaglia et al. (1999a, b).

The Diamond Tail and Galisteo fms comprise upper Paleocene and Eocene sedimentary rocks that were deposited in the Galisteo basin, a Laramide basin developed in response to basement-cored uplifts in the current location of the Sangre de Cristo and Nacimiento Mts. Paleocurrent data indicate deposition in the Galisteo basin was by extensive river systems flowing to the south (Gorham and Ingersoll, 1979; Kautz, 1981; Smith, 1992). The thickness of the Diamond Tail and Galisteo fms is as much as 1300 m. Fossil mammals indicate deposition began in the early Eocene (~54 Ma) and continued through the latest Eocene (~37 Ma) (Lucas et al., 1997).

The Oligocene Espinaso Fm conformably overlies the Galisteo Fm, but marks a distinct change in deposition. The Espinaso Fm was defined by Stearns (1953a) for volcaniclastic detritus shed off of the Ortiz Mts., a lacolithic and volcanic complex, ~12-15 km east of this stop, emplaced between 27-36 Ma. The Espinaso Fm was deposited as volcanic and hypabyssal intrusive rocks were eroded off the Ortiz Mts. The Espinaso Fm is about 430 m here and contains a lower member composed of calc-alkaline rocks (hornblende+pyroxene) that are overlain by an upper alkaline (biotite+clinopyroxene) member (Erskine and Smith, 1993).

Deposits of the Santa Fe Group (Spiegel and Baldwin, 1963) are generally differentiated into two, and in some places three, informal sub-groups (Bryan and McCann, 1937, 1938; Lambert, 1968; Kelley, 1977; Hawley, 1978, 1996; Hawley et al., 1995). These sub-groups are divided into a number of formation- and member-rank units throughout much of the Española, Albuquerque, Socorro, and Palomas basins. The lower sub-group records deposition in internally drained basins (bolsons) where streams terminated at broad alluvial plains or ephemeral or intermittent playa lakes bounded by basin-margin piedmont deposits derived from emerging rift-flanking uplifts. The upper sub-group records deposition in externally drained basins where perennial streams and rivers associated with the ancestral Rio Grande fluvial system flowed toward southern New Mexico. Deposition ceased during Pleistocene time, when the Rio Grande began to incise into the earlier aggradational phase of the Santa Fe Group basin fill (Spiegel and Baldwin, 1963; Hawley, 1996; Hawley et al., 1969).

The northeastern flank of Espinaso Ridge exposes some of the oldest deposits of the Santa Fe Group in the Albuquerque Basin (*see mini-paper by Connell and Cather, this volume*). The Tanos Fm is the stratigraphically lowest preserved deposits of the Santa Fe Group exposed in the northern Albuquerque basin. The Tanos Fm rests disconformably upon Oligocene volcaniclastic conglomerate and sandstone of the Espinaso Fm (Fig. 1-4). The contact is sharp and stratal tilts do not change noticeably across this boundary; however, a continuous dip-meter log from a nearby oil test well indicates an angular relationship at this contact. The Tanos Fm is subdivided into three unmapped members: basal conglomeratic piedmont, middle mudstone and sandstone, and upper tabular sandstone. The basal member contains 25.41 Ma olivine basalt about 9 m above the base. The middle mudstone member represents a basin-floor playa-lake facies of the Tanos Fm (Fig. 1-5).

The Tanos Fm is conformably overlain by the Blackshare Fm, which contains conglomeratic sandstone, sandstone, and mudstone, commonly arranged in upward fining sequences bounded by weakly developed soils (Fig. 1-6). The basal contact of the Blackshare Fm interfingers with the Tanos Fm and is mostly covered by Quaternary alluvium in Tanos Arroyo. An 11.65 Ma ash is about 670-710 m (based on measured sections and estimated from geologic map of Cather et al., 2000) above the base.

Figure 1-4. Contact between white conglomeratic sandstone of the Espinaso Fm (left) and overlying conglomerate of the Tanos Fm (right).

Figure 1-5. Moderately northeast-dipping (to the right) basin-floor facies of the middle mudstone member of the Tanos Fm.

Composition, gravel size, and paleocurrent data indicate derivation from the Ortiz Mts. (Large and Ingersoll, 1997; Cather et al., 2000). The Espinaso, Tanos, and Blackshare fms contain abundant porphyritic hypabyssal intrusive and volcanic rocks derived from the neighboring Ortiz Mts., which are exposed on the footwall of the La Bajada fault. The upper Espinaso Fm contains alkalic rocks, as described by Erskine and Smith (1993). Overlying deposits of the Tanos Fm contain a more diverse assemblage of hypabyssal intrusive and volcanic gravels. Thermally metamorphosed Cretaceous shales and sandstones (hornfels) and fine rounded quartzite pebbles are very rare near the base, but they increase in abundance within the overlying Blackshare Fm. These hornfels are exposed near the flanks of the Ortiz Mts. and were metamorphosed during emplacement of the Ortiz porphyry at about 27-36 Ma (Maynard, 1995). Sandstones of the Espinaso Fm are quartz-poor lithic arkoses, whereas those of the overlying deposits of the Santa Fe Group are lithic arkose and feldspathic litharenite containing more quartz than in the underlying Espinaso Fm.

Figure 1-6. Blackshare Fm. Conglomerate facies (top), and upward-fining sequences of conglomeratic sandstone, sandstone, and mudstone (bottom).

End of Stop 1. Proceed south-southeast along dirt road. **0.4**

39.1 Cross Tanos Arroyo. **0.3**

39.4 Cross under power lines. **0.1**

39.5 Blackshare Ranch is straight ahead. Pass through the cattle gate and take a sharp and immediate right. **0.5**

40.0 To your left is a north-trending normal fault with down-to-the-west movement. Pink beds in stream cut near arroyo terminate at the fault. Within about 100 m west of this fault is a topographic scarp of the major fault from which this fault is a splay. **0.2**

40.2 Cross tributary of Tanos Arroyo. **0.1**

40.3 Pass through cattle gate and cross small arroyo. **0.9**

41.2 Ruin to your right. Keep straight and cross over earthen dam. **0.4**

41.6 Make a hard right at the intersection of two dirt roads. **0.3**

41.9 Bear left. Ascend hill to broad alluvial surface of the Tuerto Fm. **1.0**

42.9 Cross arroyo. **0.8**

43.7 Windmill on your right. **0.1**

43.8 Turn right onto weakly developed two-track road. **0.1**

43.9 **STOP 2:** Plio-Pleistocene basin-margin gravels of the Tuerto Fm. *San Felipe Pueblo NE 7.5' quadrangle, GPS: NAD 83, UTM Zone 013 S, N: 3,915,540 m; E: 380,210 m.*

The purposes of this stop are to: 1) summarize the geology of Plio-Pleistocene basin-margin deposits of the Tuerto and Ancha fms; 2) discuss the development of the La Bajada fault zone.

Deposits of the Tuerto Fm (upper Santa Fe Group) overlying moderately tilted beds of the Tanos and Espinaso fms, just south of the Arroyo del Tuerto (Arroyo Pinovetito of Stearns, 1953a) section along Tanos Arroyo (Fig. 1-7). The purposes of this stop are to: 1) examine the Tuerto Fm and compare it to the Ancha Fm of the Santa Fe embayment; and 2) discuss the influence of basin-bordering faults, such as the La Bajada fault. The top and base of this unit have been considered part of the Ortiz surface (Stearns, 1979). We assign the upper constructional surface to the Ortiz, also recognizing the stratigraphic and structural importance of the underlying unconformity.

Stearns (1953a) informally named the Tuerto Fm for a broad alluvial gravel associated with streams draining the Ortiz Mts. and Cerrillos Hills. The Tuerto Fm generally ranges from about 10 to 21 m in thickness and is readily distinguished by its angular basal contact with tilted beds of the Espinaso, Tanos, and Blackshare fms, and by a marked increase in maximum gravel size (cobbles and boulders are locally common) and increase in the proportion of hornfels gravel. The Tuerto Fm forms an areally extensive alluvial apron. It unconformably overlies the Espinaso, Tanos, and Blackshare fms. The Espinaso Fm and cemented conglomerates of the Blackshare Fm typically form low hills inset by the Tuerto Fm.

A thin, unnamed limestone-bearing deposit is recognized south of the main belt of Tuerto Fm outcrops, just south of San Pedro Creek. These limestone-bearing deposits constitute a lithologically differentiable unit that is coeval with the Tuerto Fm that has not yet been differentiated.

Spiegel and Baldwin (1963) defined the Ancha Fm as the uppermost part of the Santa Fe Group. They defined this deposit for exposures along Canada Ancha, where an interbedded ash was recently dated at 8.48±0.14 Ma using the ^{40}Ar/^{39}Ar method (*see mini-paper by Koning et al., this volume*), which suggests that this unit is probably too old to be correlative to the Ancha Fm. Much of this section is lithologically similar to the Pojoaque Mbr of the Tesuque Fm. Therefore, we consider most of the type Ancha section to be correlative to the underlying Tesuque Fm. The Ancha Fm was mapped as a granite-bearing gravel and sand derived from the southwestern front of the Sangre de Cristo Mts. in the Santa Fe embayment, near Santa Fe, New Mexico. Exposures extend from just north of the Santa Fe River, to Galisteo Creek. Although the type section of this unit was mis-correlated by Spiegel and Baldwin (1963), it has been mapped in a consistent manner throughout the Santa Fe embayment and, thus is a stratigraphically useful term. Therefore, we propose replacing the Cañada Ancha section with a new type section near Lamy, New Mexico.

Figure 1-7. View to south of angular unconformity between northeast-tilted beds of the Espinaso Fm (white) and overlying sub-horizontally bedded Tuerto Fm. Sandia Mts. in background.

The Ancha Fm contains abundant granite with less amounts of gneiss and schist. The Ancha Fm is compositionally distinct from the Tuerto Fm, which contains porphyrytic andesite and monzanite and hornfels derived from the Ortiz Mts. The Tuerto Fm locally overlies the Ancha Fm along the southern margin of Galisteo Creek, indicating that these two formations are coeval in part. The Tuerto and Ancha fms are locally overlain by Pliocene basalt flows of the Cerros del Rio field, which were mostly emplaced between 2.3 and 2.8 Ma (*cf.* Woldegabriel et al., 1996). The age of the Ancha Fm is constrained by the presence of tephra Ar/Ar dated at 1.48 Ma, which is temporally correlative to the Cerro Toledo Rhyolite, from the Jemez Mts. This ash, and another dated at 1.61 Ma, lie near the top of the Ancha Fm (Read et al., 2000). In Bonanza Wash, just east of the Cerro Bonanza in the Cerrillos Hills, an ash containing 1.26 Ma tephra is recognized in deposits associated with Bonanza Creek (*Koning et al., this volume*). This ash-bearing deposit is interpreted to be inset against the Ancha Fm. Thus, the entrenchment of the Ancha Fm, near Bonanza Creek, began between 1.5 and 1.2 Ma. This entrenchment of the Ancha constructional surface, called the Plains surface by Spiegel and

Baldwin (1963), was probably not synchronous. The Ancha Fm is thin and contains fallout tephra of the lower Bandelier Tuff (Read et al., 2000) near the mouth of Arroyo Hondo, suggesting that the Ancha Fm was deposits during early Pleistocene time along that segment of the mountain front. Along the southern flank of the Sangre de Cristo Mts., granitic deposits containing preserved constructional deposit tops have only weakly developed soils, commonly exhibiting Stage I to II carbonate morphology. These deposits are nearly indistinguishable from the underlying Ancha Fm and are not differentiated on maps. This weak soil development suggests that deposition of the Ancha Fm deposition continued into the middle Pleistocene along parts of the front of the southern Sangre de Cristo Mts., especially near Seton Village, New Mexico. Similar soil-geomorphic relationships are recognized in the Tuerto Fm along the flanks of the Ortiz Mts.

These three units are relatively thin, unconformably overlie older rocks with distinct angularity, and are recognized along the rift margin where they are associated with mountainous drainages. These deposits locally contain an unmapped, well cemented lower member that is overlain by poorly exposed, weakly cemented upper members that contain remnants of soils exhibiting Stage II to III+ carbonate morphology. The well cemented units contain abundance fine- to medium-grained sparry calcite, suggesting prolonged saturation of these deposits by groundwater. Younger inset alluvial and fluvial deposits typically do not contain such well cemented intervals, presumably because they were deposited during long-term dissection of tributary drainages. These deposits would constitute members of a formation, however, they all contain locally differentiable sub-units, thus rendering a member rank for these units problematic. These units comprise a group of relatively thin strata associated with faulted basin-margin flanks that record a slightly different geologic history compared to nearly continuous deposition within sub-basin depocenters.

North of NM-22, the Tuerto Fm is cut by the La Bajada fault, however, displacements significantly decrease to the south and probably bury the southern tip of the La Bajada fault..

End of Stop 2. Turn vehicles around and retrace steps to dirt road. **2.0**

45.9 Bear right. **0.4**

46.3 At intersection, go straight. **0.4**

46.7 Take a sharp left. **0.5**

47.2 Gravel on top of ridge may be remnants of Tuerto Fm. **0.6**

47.8 Pass through cattle gate. Keep right. Metal pole near road to your left is the Marion Oil Co. Blackshare No. 2 oil test well, which ended in the Morrison Fm at 2079 m (6820 ft) below land surface. **0.8**

48.6 Bear right. **0.1**

48.7 Merge right. **0.6**

49.3 Pass through cattle gate. Turn left onto dirt road (NM-22). To your right is the La Bajada fault capped by Pliocene basalts of the Cerros del Rio volcanic field. To the north are the Cerrillos Hills. **2.0**

51.3 Descend northeast-trending scarp of Budagher fault, which has down-to-the-northwest normal movement. The Budagher fault is mapped between the San Francisco and La Bajada faults and probably represents a hard-linked relay fault between these rift-border structures. **1.6**

52.9 Left onto I-25 southbound onramp. **1.6**

54.5 East tilted mudstone and sandstone of Sierra Ladrones Fm piedmont deposits on your left. **0.5**

55.0 Driving over approximate location of trace of the San Francisco fault, which is buried here by Quaternary sediments. **2.6**

57.6 Gray sands at the bottom of arroyo face contain Bandelier Tuff. White beds along I-25 are correlated to a 1.57 Ma ash of one of the Cerro Toledo events (*see notes for mileage 30.5*). **0.9**

58.5 Cuestas at 9:00 are Dakota Sandstone. Underlying white deposits are Todilto Fm gypsum beds exposed at a quarry. **0.5**

59.0 White ash of 1.57 Ma Cerro Toledo Rhyolite at 10:00 (*see notes for mileage 30.5*). **0.5**

59.5 Tonque Arroyo overpass. To the right, the eastern edge of the upper Pliocene basalts at Santa Ana Mesa are interbedded with ancestral Rio Grande deposits of the Sierra Ladrones Fm. **1.2**

60.7 To your left are brownish-yellow stained fluvial Sierra Ladrones deposits. This zone of staining is along a north-trending zone that is the northern extension of a north-trending fault mapped to the south. **1.5**

62.2 This stretch of the highway contains a number of irregular dips associated with hydrocollapsible soils of latest Pleistocene-Holocene valley border fan deposits derived from sandy deposits of the upper Santa Fe Group to the east. **5.8**

68.0 Water tanks to the left sit on a middle Pleistocene piedmont gravel that unconformably overlies reddish-brown sandstone of the Loma Barbon Mbr of the Arroyo Ojito Fm. Assignment of these reddish-brown sediments to the Arroyo Ojito Fm is ambiguous, primarily because of the paucity of gravel. This assignment is made primarily based on comparisons to similar strata exposed west of the Rio Grande valley. **1.5**

69.5 Bear right and leave I-25 at Placitas and Bernalillo offramp (exit 242). **0.2**

69.7 Turn left at the stop sign at the top of the offramp. **0.7**

70.4 Ascend hill and travel on middle Pleistocene piedmont deposits derived from the northern Sandia Mts. **0.9**

71.3 The arroyo to the left, beyond house in floodplain, exposes rounded quartzite and brown, cliff-forming sandstone and conglomerate of the ancestral Rio Grande and piedmont deposits, respectively, of the Sierra Ladrones Fm. Piedmont deposits contain limestone, granite, and sandstone derived from the Sandia Mountains. To the east and stratigraphically above this fluvial gravel in the arroyo are lenses of ancestral Rio Grande deposits containing fluvially recycled pumice cobbles (not visible from road). One of these cobbles has been dated at 1.61±0.02 Ma (Connell et al., 1995) and is temporally correlative to the lower Bandelier Tuff, which was derived from the Jemez Mts. **0.8**

72.1 Homestead Village strip mall to your left. Between 10:00 and 12:00 the northwest-trending escarpment marks the Valley View fault, which terminates to the south near the Rincon fault (Connell et al., 1998). Within the next mile is the eastern projection of ancestral Rio Grande facies of the Sierra Ladrones Fm, which is overlain by piedmont deposits here. **0.5**

72.6 Rincon ridge is your right. **0.3**

72.9 Milepost 3. Hills in the foreground are post-Santa Fe Group middle Pleistocene gravels that overlie stream-flow dominated piedmont sandstone and conglomerate of the Sierra Ladrones Fm. **0.5**

73.4 Las Placitas site marker. Low angle fault is part of Ranchos fault zone, which juxtaposes Santa Fe Group deposits against Cretaceous sandstone, shale, and coal. You have just crossed the border of the rift and are on the northern flank of the Sandia Mts. **1.3**

74.7 Pass intersection with Puesta del Sol Rd. **0.1**

74.8 Turn right onto Tunnel Springs Rd. and begin to ascend the Las Huertas surface. Deposits underlying this constructional piedmont surface unconformably overlie older tilted rocks and are inset against undivided lower Santa Fe Group piedmont conglomerate and sandstone. The basal contact of these deposits has a slightly unconformable relationship with underlying upper Santa Fe Group beds of the piedmont facies of the Sierra Ladrones Fm to the north, across the Escala fault; however, these deposits are conformable further into the basin. This relationship suggests that the La Huertas geomorphic surface marks a local top of the upper Santa Fe Group on the hanging wall of the Escala fault (Connell and Wells, 1999). **0.2**

75.0 Intersection with Quail Meadow Rd. Tunnel Springs is visible at 11:00. It is the area that is marked by dense cottonwood vegetation, which contrasts with the surrounding Piñon-Juniper woodland. **1.3**

76.3 **STOP 3:** Tunnel Springs. *Placitas 7.5' quadrangle, GPS: NAD 83, UTM Zone 013 S, N: 3,906,400 m; E: 369,080 m.*

This is an overview stop of some stunning views of the northern flank of the Sandia Mts. and northern Albuquerque basin. Tunnel Springs emanates from the Placitas fault zone.

The purposes of this stop are to: 1) discuss the stratigraphy of the lower Santa Fe Group strata exposed in the Placitas area; 2) discuss the tectonic development of the northern flank of the Sandia Mts. and Santo Domingo sub-basin; and 3) discuss previous models of development of the basin, including the existence of the postulated Rio Grande fault.

The northern flank of the Sandia Mts. is a north-plunging structural ramp created by a 6.5-km wide eastward step in the rift-bounding Rincon and San Francisco faults. A complicated zone of steep faults called the Placitas fault zone accommodates this step. The origin of this step has created much controversy. Kelley (1977, 1982) considered this feature to be a relay ramp associated with left-oblique movement along the San Francisco and Rincon faults; however, there is no strong evidence for transpression in this step over, which would be the likely result of a right step on a left-oblique fault system. Karlstrom et al. (1999), proposed that the Placitas fault zone represented an older, steeply dipping, northeast-trending strike-slip fault of Laramide age that was reactivated during the Neogene. Paleomagnetic studies of a single 30.9 Ma mafic dike in the Placitas area (Connell et al., 1995) indicates that much of the deformation post-dates emplacement of the dike (Lundahl and Geissman, 1999). It is likely that the northern Sandia Mts. represents a breached relay ramp or transfer zone that formed during development of the Rincon and San Francisco faults.

The Santa Fe Group in the Placitas area contains a record of early unroofing of the Sandia Mts. Along Overlook Rd. on the southern flank of Lomos Altos, the Santa Fe Group is well cemented with sparry calcite and rests with angular unconformity on Cretaceous sandstone and shale. This section is conglomeratic. The base contains abundant Permian sandstone and minor limestone, most likely derived from the Glorieta and San Andres fms. Upsection the gravel is predominantly reddish-brown sandstone of the Abo Fm. Near the top of the exposed section, gravel is predominantly limestone and cherty limestone derived from the Pennsylvanian Madera Fm. At the southern tip of the Cuchilla de Escala, the composition of the Santa Fe Group gravel contains abundant rounded cobbles and pebbles of porphyryitic intrusive rocks derived from the Ortiz Mts. This gives way upsection to a mixture of sandstone, limestone and Ortiz-derived rocks.

The juxtaposition of these differing source areas indicates that during early development of the rift, sediment was being derived from both an emerging Sandia Mts., and a degrading (eroding) Ortiz Mts. The location of Ortiz-derived gravel also indicates that the Cuchilla de San Francisco had not been uplifted enough to affect the composition of the gravel, at least not initially.

Another interesting unroofing sequence was recognized in the post-Santa Fe Group inset stratigraphy, where the topographically highest inset gravels are composed almost exclusively of limestone. On progressively inset deposits, the composition becomes more heterolithic, and granite and metamorphic rocks become more common in the late Pleistocene and Holocene deposits associated with the modern valley floors that head into the northern flank of the Sandia Mts. This Plio-Pleistocene unroofing sequence is recorded in a deeply dissected geomorphic region, or domain, that is structurally defined by the Ranchos, Lomos, Escala and Placitas faults (Connell and Wells, 1999). This geomorphic domain records progressive dissection along the northern flank of the Sandia Mts. that occurred in response to migration of the locus of faulting from the Placitas and southern San Francisco faults basinward to the Lomos, Escala, and Valley View faults, which probably started during late Pliocene time, prior to deposition of the gravel of Lomos Altos.

The Placitas area was interpreted to represent the surface expression of major listric faults that define the eastern basin margin. Woodward (1977) first proposed listric geometries for faults of the basin. These are recognized on seismic data (deVoogd et al., 1988; Russell and Snelson, 1994) and are suggested by increasing tilts of basin-margin fault blocks. This listric geometry is expressed on seismic profiles along the southern margin of the basin. Russell and Snelson (1994) propose that the Albuquerque Basin narrowed significantly between the late Miocene and Pliocene and that the range-bounding master faults of the Sandia Mts. were cut by a younger intrabasinal listric-normal fault having up to about 6 km of displacement of Cenozoic strata. They proposed that offset along this major intrabasinal structure, which they named the Rio Grande fault, began when the range-front master fault migrated basinward about 15-20 km to the west.

Significant displacement of Cenozoic strata is recognized in seismic-reflection lines and deep oil-test data near Isleta Pueblo (Russell and Snelson, 1994; May and Russell, 1994). Subsurface studies in the Albuquerque area indicate that much of the Santa Fe Group strata thicken and tilt to the northeast (Connell et al., 1998a) and are not displaced across the projected trace of the Rio Grande fault of Russell and Snelson (1994). Geomorphic and stratigraphic studies along the northern flank do not support the presence of such a young and large magnitude structure (Connell and Wells, 1999). Late Quaternary movement of range-bounding faults of the Sandia Mts. indicates that faults along the eastern structural margin of the Calabacillas sub-basin were active during Pleistocene time, at least locally (Connell, 1996).

Gravity data indicates that the basin-margin is marked by a 2-3 km wide zone of normal faults that extend about 3-6 km west of the front of the Sandia Mts. (Cordell, 1979; Grauch et al., 1999; Connell et al., 1998a). The gravity data also suggest that Russell and Snelson’s Rio Grande fault may be correlative with an older northwest-trending feature, rather than a younger north-trending fault (Maldonado et al., 1999). This northwest-trending zone is called the Mountainview fault to avoid confusion with Russell and Snelson’s postulated Rio Grande fault. The Mountainview fault coincides with a northwest-trending gravity ridge (Grauch et al., 1999, *this volume*) and likely marks the part of the structural boundary between the Calabacillas and Belen sub-basins (Maldonado et al., 1999). Thus, the low-angle fault shown described by Russell and Snelson (1994) may the result of apparent dip of the northwest trending Mountainview fault, rather than a true dip of a low-angle fault.

The projected trace of the Rio Grande fault is buried by Plio-Pleistocene sediments and is west of a prominent inflection in the isostatic gravity field (Cordell, 1979; Grauch et al. 1999). Geomorphic and stratigraphic evidence (Connell and Wells, 1999; Connell et al., 1998a) also indicate that the Rio Grande fault is not a young intrabasinal normal fault. Basin narrowing is recognized throughout the basin (Russell and Snelson, 1994), but is commonly restricted to prominent steps or re-entrants in the basin margin (Connell and Wells, 1999; Connell, 1996). At the northern flank of the Sandia Mts. is an excellent example of such a step-over fault. The Placitas fault zone accommodates slip across the Rincon and San Francisco faults, and forms an east-stepping ramp (Connell and Wells, 1999; Connell et al., 1995). Using the down-plunge method of cross section construction, several workers (Woodward and Menne; 1995; Russell and Snelson; 1994; May et al., 1994) suggested that the trace of the Placitas fault zone (northern structural boundary of the Sandia Mts.) is curved in map view. They interpreted apparent curvature as indicative of a listric fault plane at depth; however, the trace of the Placitas fault zone is rather straight (Connell et al., 1995), suggesting a steep dip. Furthermore, the down-plunge method may have been misapplied, principally because the southward direction of projection is nearly perpendicular to the Placitas fault zone. Instead, the Placitas fault zone probably acts as a transfer zone between the frontal faults of the Sandia Mts. and the San Francisco fault (Karlstrom et al., 1999).

In summary, the Rio Grande fault concept of Russell and Snelson (1994) is not supported for the following reasons:

1) Geomorphic evidence does not support the presence of a long, discrete intrabasinal fault having a large magnitude of post-Miocene displacement (Connell and Wells, 1999);
2) Regional geophysical surveys (principally isostatic residual gravity, and aeromagenetic surveys) do not support the presence of a north-trending intrabasinal fault zone (Grauch et al., 1999; Grauch, 1999);
3) Studies of borehole geophysics and cuttings from numerous wells in the Albuquerque area identify marker units that are not displaced across the projected trace of the Rio Grande fault (Connell et al., 1998a); and
4) Stratigraphic data are inconsistent with the development of this structure (Connell and Wells, 1999; Maldonado et al., 1999).

End of Stop 3. Retrace route to NM-165. **1.4**

77.7 Turn left at stop sign onto NM-165. **2.2**

79.9 At 3:00 in the hills covered by numerous houses on the footwall of the Valley View fault, notice interfingering of light-gray sand of the ancestral Rio Grande sands and light-brown piedmont deposits. You are near the eastern limit of the ancestral Rio Grande, as projected onto NM-165 (Connell et al., 1995). **2.6**

82.5 Turn right on north frontage road. **0.2**

82.7 Reddish-brown sandstone of the Loma Barbon Mbr unconformably overlain by Edith Fm. **0.2**

82.9 Turn right onto Yearsley Ave. Note the road cut on the adjacent road to the north (La Mesa Rd). Here red east-tilted Loma Barbon deposits are interbedded with gray Rio Grande sand and unconformably overlain by quartzite gravels of the Edith Fm. **0.3**

83.2 Normal fault with down-to-the-east movement to your left. **0.4**

83.6 **STOP 4:** LaFarge gravel pit operation. *Bernalillo 7.5' quadrangle, GPS: NAD 83, UTM Zone 013 S, N: 3,910,800 m, 362,837 m.*

Deposits of the ancestral Rio Grande and interfingering piedmont deposits derived from the northern Sandia Mts. (upper Santa Fe Group). The purposes of this stop are to: 1) examine ancestral Rio Grande and piedmont members (or facies) of the Sierra Ladrones Fm; 2) discuss ongoing studies of deposit provenance and lithologic differentiation of the Sierra Ladrones and Arroyo Ojito fms in the northern Albuquerque Basin; and 3) discuss evidence of continuous aggradation of upper Santa Fe Group deposits through late Pliocene-early Pleistocene time.

At this stop we will examine exposures of Plio-Pleistocene fluvial deposits of the ancestral Rio Grande system and interfingering piedmont deposits. Ancestral Rio Grande deposits are gravelly with scattered rip-up clasts of mudstone (Fig. 1-8). The ancestral Rio Grande fluvial system is documented to be at least 6.9 Ma, based on the presence of quartzite-bearing fluvial conglomeratic sandstone that was affected by the emplacement of the late Miocene Peralta Tuff, near Tent Rocks and Cochiti, New Mexico (Smith and Kuhle, 1998; Smith et al., 2001). Between Bernalillo and Tonque Arroyo, three facies tracts can be seen: the western fluvial facies of the Arroyo Ojito Fm (Connell et al., 1999); the central axial-river facies of the ancestral Rio Grande, and streamflow-dominated piedmont deposits derived from rift-margin uplifts, such as the Sandia Mts. Geologic mapping indicates that the ancestral Rio Grande member of the Sierra Ladrones Fm interfingers with the piedmont member.

Figure 1-8. Photograph of ancestral Rio Grande gravels in the La Farge gravel pit at Placitas (Bernalillo quadrangle). Note the mudstone rip-up clasts. The upper part of the outcrop is dumped fill from quarry operations.

These major, mappable lithofacies assemblages in the SE Santo Domingo and Calabacillas sub-basins are the: western-margin facies, central ancestral Rio Grande facies, and the eastern-margin piedmont facies. The western margin facies is the Arroyo Ojito Fm, which represents the fluvial facies of the ancestral Rio Puerco, Rio Jemez/Guadalupe, and Rio San Jose. Sediments were probably derived from the Sierra Nacimiento, San Juan Basin, and Colorado Plateau to the west and northwest of the Albuquerque basin. The ancestral Rio Grande lithofacies is part of the Sierra Ladrones Fm and represents deposits of the through-flowing axial-river system of the Rio Grande. The eastern piedmont facies is part of the Sierra Ladrones Fm and contains detritus shed from rift-flanking uplifts, such as the Sandia Mountains.

Large and Ingersoll (1997), in a study of sand petrography in the northern part of the Albuquerque Basin, concluded that deposits of the Santa Fe Group were not petrographically differentiable. A current study of gravel and sand composition (Derrick and Connell, 2001) indicates that these mapped facies are indeed differentiable, as discussed below.

Preliminary results of point counts of pebbles and cobbles in the northern Albuquerque Basin (Fig. 1-9) indicate that the Arroyo Ojito Fm contains abundant volcanic tuffs and fine- to medium-grained red granites with lesser amounts of Pedernal chert, basalt, sandstone, and white quartzite. The ancestral Rio Grande member of the Sierra Ladrones Fm commonly contains rounded, bedded quartzites of various colors and diverse volcanic and intrusive rocks, including tan and gray tuffs, diabase, and granite. Sedimentary rocks are rare. The eastern piedmont deposits contain abundant limestone, sandstone, coarse-grained pink granite, and sparse igneous rocks.

Sand composition from point counts of 400 grains per sample show that these mapped facies are not as easily differentiable as the gravel counterparts. The sand is quartz rich (46-85% quartz) and facies exhibit considerable compositional overlap when plotted using the modified Gazzi-Dickinson method. Compositional trends are observed when proportions of chert, granite, and volcanic grains are compared (Fig. 1-10).

There is a stronger correlation among the lithofacies using gravel. Possible explanations for this correlation include the shorter transport distance of gravel from the source area, similar source areas for the ancestral Rio Puerco and the ancestral Rio Grande, or greater sediment recycling and transport of the finer-grained sand fraction.

Near this stop, a series of stratigraphic sections were measured on San Felipe Pueblo that document the interaction of these facies from late Pliocene through early Pleistocene time. In the Santo Domingo sub-basin, the Santa Fe Group experienced continuous deposition prior to 2.2 Ma to younger than 1.6 Ma. Deposition of the system ceased as the Rio Grande began to incise into the basin fill. A fluvial terrace deposit containing the middle Pleistocene Lava Creek B ash is inset against the basin fill, indicating that incision was underway prior to *ca*. 0.66 Ma.

Paleocurrent data measured from gravel imbrications, channel orientations, and cross beds for deposits in the southeastern Santo Domingo sub-basin and Calabacillas sub-basin (Cather and Connell, 1998; Cather et al., 1997, 2000; Connell, 1998; Connell et al., 1995, 1998, 1999; Derrick, unpubl. data) indicate that coarse-grained sediments of the Arroyo Ojito Fm flowed to the S-SE (Fig. 1-11a), ancestral Rio Grande deposits of the Sierra Ladrones Fm flowed to the S-SW (Fig. 1-11b), and eastern-margin piedmont deposits of the Sierra Ladrones Fm flowed to the west (Fig. 1-11c, d).

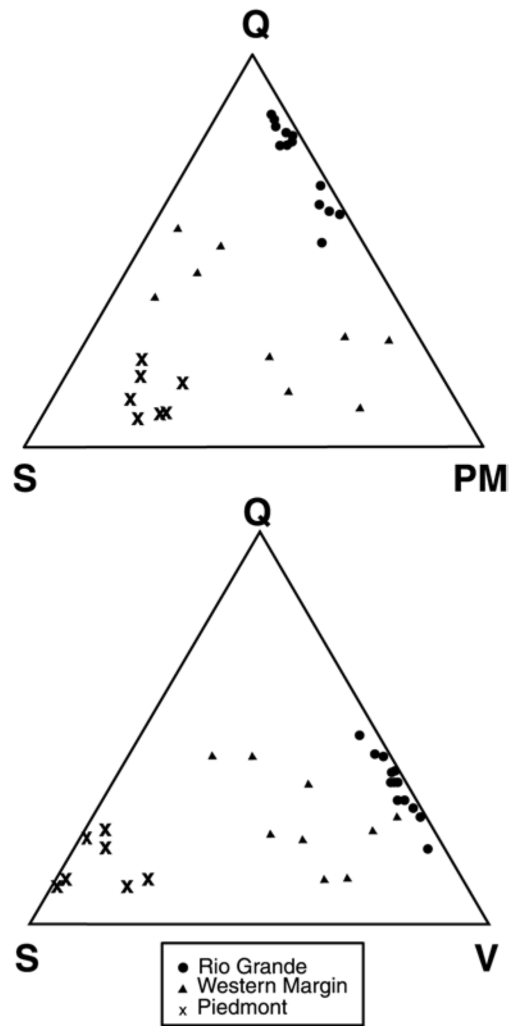

Figure 1-9. Preliminary gravel petrography from selected localities in the SE Santo Domingo sub-basin and Calabacillas sub-basin (N. Derrick, unpubl. data). Rio Grande and piedmont samples are from the Sierra Ladrones Fm; western margin denotes samples from the Arroyo Ojito Fm. Abbreviations include quartz, quartzite, and chert (Q), sedimentary (S), volcanics (V), and plutonic-metamorphic (PM) gravels.

End of Stop 4. Retrace route to frontage road at entrance to gravel pit. **0.7**

84.3 At stop sign turn to your left, getting back out onto the frontage road heading south. **1.4**

85.7 At the intersection of the frontage road and NM-165, go straight, remaining on the frontage road heading south. **0.3**

86.0 Light-brown middle Pleistocene sand and gravel overlie rounded quartzite-dominated gravel of the Edith Fm. **0.2**

86.2 Entrance gate to reclaimed aggregate mine. Must get permission from owner to enter. Turn left. **0.3**

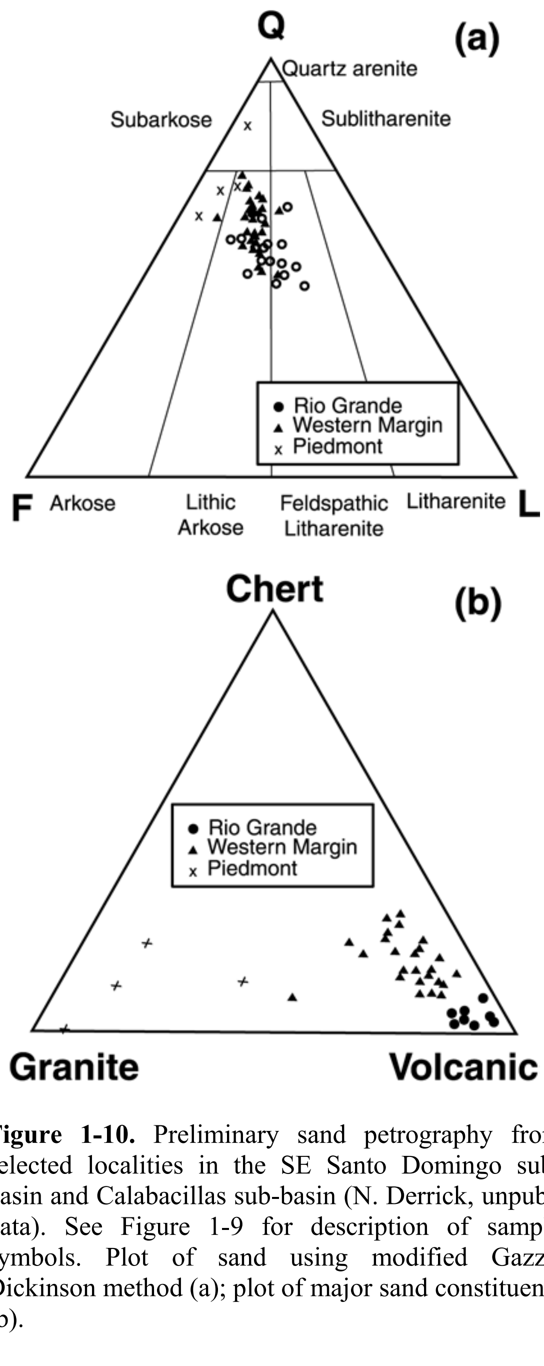

Figure 1-10. Preliminary sand petrography from selected localities in the SE Santo Domingo sub-basin and Calabacillas sub-basin (N. Derrick, unpubl. data). See Figure 1-9 for description of sample symbols. Plot of sand using modified Gazzi-Dickinson method (a); plot of major sand constituents (b).

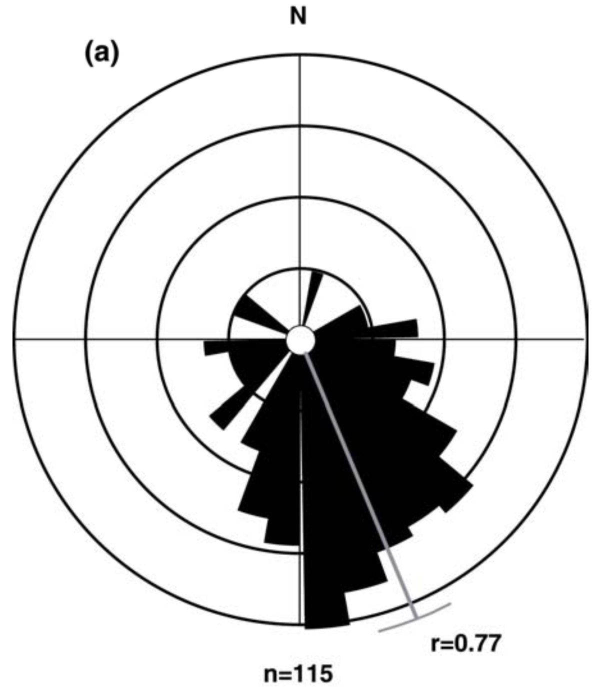

Figure 1-11a. Paleocurrent rose for Arroyo Ojito Fm (western margin) deposits (at 10° intervals), including correlation coefficient (r). Data from Cather et al. (1997), Connell et al. (1999), Koning (unpubl.), and Derrick (unpubl.).

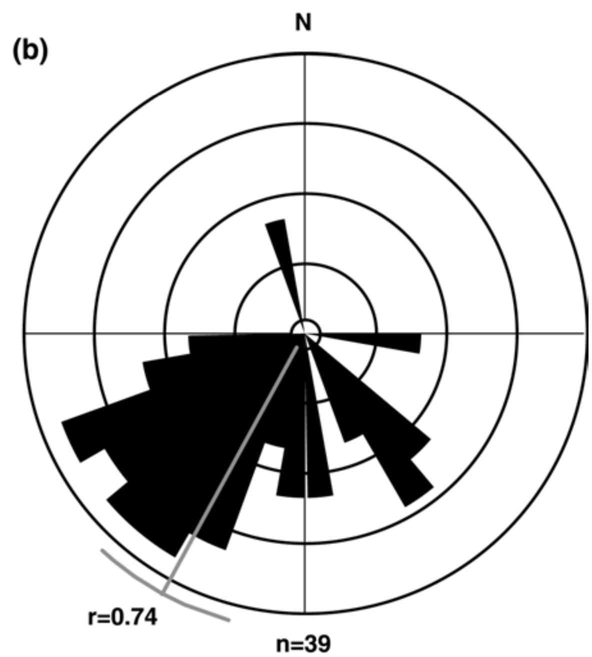

Figure 1-11b. Paleocurrent rose for ancestral Rio Grande deposits (at 10° intervals), including correlation coefficient (r). Data from Cather and Connell (1998), Cather et al. (2000), Connell (1998), Connell et al. (1995), and Derrick (unpubl.).

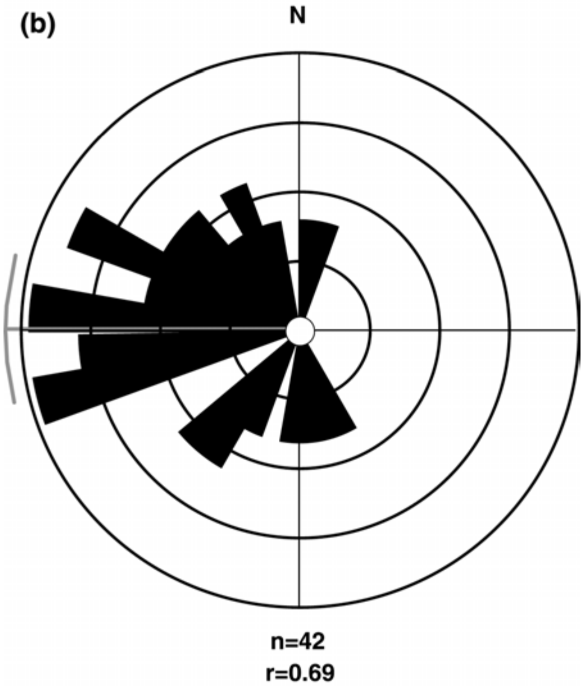

Figure 1-11c. Paleocurrent rose for younger eastern-margin piedmont deposits (Sierra Ladrones Fm, at 10° intervals), including correlation coefficient (r). Data from Cather and Connell (1998), Connell et al. (1995), and Derrick (unpubl.).

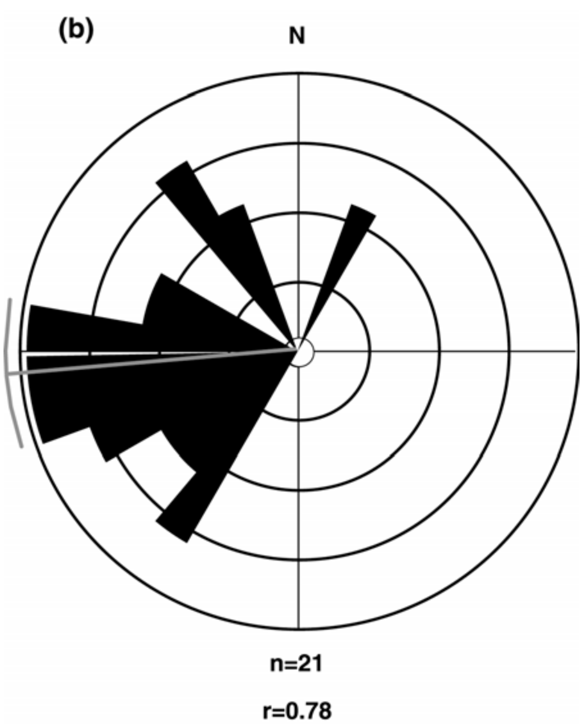

Figure 1-11d. Paleocurrent rose for older eastern-margin piedmont deposits (Santa Fe Group, at 10° intervals), including correlation coefficient (r). Data from Connell et al. (1995).

86.5 **STOP 5:** *Bernalillo 7.5' quadrangle, GPS: NAD 83, UTM Zone 013 S, N: 3,908,060 m; E: 360,720 m.*

Inset stratigraphic relationships between aggradation of the Santa Fe Group and post-Santa Fe Group entrenchment (*see mini paper by Connell and Love, this volume*), including a buttress unconformity between the Edith Fm and piedmont deposits, with the Sierra Ladrones Fm. We will hike eastward, up an unnamed arroyo to examine the inset stratigraphic relationship of a middle Pleistocene fluvial deposit of the ancestral Rio Grande called the Edith Fm. The purposes of this stop are to: 1) examine the Edith Fm and its basal strath with underlying upper Santa Fe Group strata; 2) examine a buttress unconformity between the Edith Fm and the Santa Fe Group; and 3) discuss the timing of entrenchment of the basin fill and development of the Rio Grande Valley.

The gravel quarry is surface mining the quartzite-bearing cobble and pebble gravel of the base of the Edith Fm. This coarse gravel commonly lies on fluvial deposits of the Sierra Ladrones Fm or Arroyo Ojito Fm with slight angularity. The gravel fines up into sand, which commonly forms an upward fining sequence with a locally preserved weakly developed soil. The Edith Fm is overlain by middle to late Pleistocene gravel and sand derived from the Sandia Mts. As we travel upstream, the Edith Fm is buried. About 1 km to the east is a buried paleobluff cut by the Edith Fm. The piedmont deposits formed a valley border fan that eventually buried this bluff. The rounded gravels in the tilted Santa Fe Group are thin beds of ancestral Rio Grande deposits, which extend ~2.4 km to the east, where it occupied a proximal position to the mountain front until early Pleistocene time.

Retrace route back to NM-165. End of first-day road log.

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