Supplemental road log 3: From intersection of US-64 and NM-434 near Angel Fire, across Palo Flechado Pass to Taos

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should return. The route ahead is recommended only for four-wheel-drive vehicles. **0.4**

3.3 **STOP 15.** The Inferno mine, on the east side of Pioneer Creek, consists of seven claims (Schilling, 1960) that were patented in 1905 (Survey No. 1179,42178). The main adit is caved, but the dump indicates several hundred meters of workings. This prospect was first worked in the early 1900's by an Italian miner named Moriano. Ore from the main tunnel on the left side of the road was assayed at $60/ton in 1912–1913. The building was erected by A. Picchyi and his sons when they began exploration in 1971 and 1975. At this point **there is no public right-of-way and all vehicles must turn back. 0.25**

3.55 The Caribel or Pratt mine and millsite, consisting of 13 patented claims, was patented in 1922 (Survey No. 1756,865943). H. L. Pratt owned and operated this mine and organized the Caribel Milling and Mining Company in 1910. The remains of a three-story, 25-ton cyanide mill, assay office, bunkhouses, cookhouse, barns and several other buildings are at the site. In 1917, 12 to 24 families lived in cabins near the mine (Pearson, 1986). Upslope about 300 m, Pratt built a ditch to divert water from the creek into a pipe in order to generate pressure to power the waterwheel. In 1913, the mill produced over $2000 of gold and silver (Pearson, 1986). A 32-m long shaft yielded assays of $20/ton in 1915. Several hundred tons of ore averaging $18/ton of gold and silver were traded in 1921 (Schilling, 1960). A number of shallow pits and shafts 4–24 m deep are found south of the millsite. The main shaft had 6 levels and was about 53 m deep. Quartz veins up to 4 m wide with pyrite and calcite, carrying some gold and silver, cut Proterozoic metamorphic rocks, Tertiary quartz latite, Tertiary latite and Tertiary sedimentary rocks. Although total production is said to have been over $100,000, financial problems throughout the 1920's finally forced the closure of the mine in the early 1930's. In 1979, the mill was torn down, and the 70,000 board-feet of lumber in the mill salvaged.

Return to Red River by retracing this route. **3.55**

7.1 Red River.

End of Supplemental Road Log 2.

SUPPLEMENTAL ROAD LOG 3, FROM INTERSECTION OF US-64 AND NM-434 NEAR ANGEL FIRE, ACROSS PALO FLECHADO PASS TO TAOS

ROBERT M. COLPITTS, JR. and CLAY T. SMITH

Distance: 18.9 mi
Stops: 3

SUMMARY

This trip covers a portion of the route traversed by the 1956 New Mexico Geological Society Annual Field Conference third-day road log (Wanek and Read, 1956), crossing numerous exposures of Pennsylvanian strata and Carson Conglomerate(?) of Just (1937) in the Carson National Forest. Much information about the Pennsylvanian section has been acquired in the intervening 34 years through studies by Miller et al. (1963), Sutherland and Harlow (1973), Casey and Scott (1979), Casey (1980a, b) and Smith and Colpitts (1980). Casey (1980a) described a series of stratigraphic sections along this route and used the data to interpret the depositional environments of these rocks. Some of his interpretations are included where appropriate.

This trip provides an opportunity for geologists to examine outcrops of Pennsylvanian-age strata in a deep part of the Taos trough (Rowe-Mora basin of other writers) (Casey, 1980a, b). It also affords an opportunity to compare and contrast these strata with those exposed east of Mora in the southern part of the basin. The best exposures (though apparently thrust-faulted) are exposed on either side of Palo Flechado Pass along US-64. We advise extreme caution when examining these outcrops. The highway has numerous sharp curves and switchbacks that may conceal your presence to traffic. Other exposures of these same strata exist in the canyon south of the highway and near Taos, north of the highway in canyons and arroyos.

Mileage

0.0 **Intersection of US-64 and State Highway 434. Proceed west on US-64.** Valley floor comprises a thick sequence of late Tertiary to Quaternary pediments, lake deposits and stream alluvium. Hills at 3:00 to 9:00 are underlain by Pennsylvanian strata belonging to the Porvenir-Alamitos Formations undivided and Flechado/Sandia Formations (see Colpitts and Smith, 1990, for further discussion). **1.1**

1.1 Outcrop at right is Pennsylvanian sandstone, possibly Alamitos Formation. Old wagon road to Black Lake visible to left from 7:00 to 10:00. **0.1**

1.2 West Moreno Ranch road to right. Entering Carson National Forest. **0.1**

1.3 Rocks to right and ahead along road are coarse-grained, micaceous, feldspathic to arkosic, crossbedded sandstones of the Porvenir-Alamitos Formations. Forest road to left. **Caution: next several miles are steep winding roads with several sharp turns and switchbacks. 0.2**

1.5 Forest road (now a snowmobile trail) to left. This trail was originally the stagecoach road from Cimarron to Taos built sometime in the 1800's over what was then known as Taos Pass (now known as Palo Flechado Pass). Stevenson (1881) described the exposures of Pennsylvanian strata along this old road. His descriptions are easily followed even today. Begin climb of Palo Flechado Pass. **0.05**

1.55 Outcrop of Pennsylvanian sandstone on left. **0.1**

1.65 Outcrop of Pennsylvanian sandstone on left. Note steep dips. **0.05**

1.7 Excellent exposures of Pennsylvanian sandstones on left. Steeply dipping silty sandstone, siltstone and shale may be equivalent to Baltz's Alamitos Formation (restricted) because of the occurrence of red beds in the sequence in the canyon immediately to the south and at the foot of the pass to the east. However, faunal data collected a short distance down section (up the pass) suggest that these rocks may actually belong to the Porvenir Formation of Baltz and Myers (1984). **0.1**

1.8 Roadcut to right is the same sequence described above. Some crinoid ossicles apparent. **0.05**

1.85 Roadcut on right and ahead exposes sandstone and shale sequence dominated by fine- to medium-grained silty sandstone. **0.15**

2.0 Crossbedded fine- to coarse-grained sandstone in roadcut to the right. Crossbeds well developed and represent a channel deposit of a braided-stream/shelf-sand sequence (Casey, 1980a). Sandstone is micaceous and feldspathic to arkosic with no apparent conglomerates in these beds. Sequence fines upward to fine- to medium-grained sandstone with local shale partings. This grades up into the sequence exposed at mile 1.7. Fine sequence may represent an interbedded crevasse splay-channel package. **0.05**

2.05 Outcrop on right is stratigraphically below previous outcrop. Rocks are finer grained with evidence of channel abandonment (dark gray, locally fossiliferous, calcareous siltstones and limestones). Fossils include various brachiopods, rugose corals, phylloid algae and crinoid ossicles. **0.05**

2.1 Outcrop on right is the down-section continuation of outcrop at mile 2.05. Channel sandstone is underlain by shale and siltstone. A second channel underlies the shale and siltstone. **0.15**

2.25 Coarse-grained channel sandstone to right in cut. **0.1**

2.35 Sandstone channel with interbedded shale sequence characteristic of Porvenir/Alamitos Formations in this area. **0.15**

2.5 Dips of strata becoming steeper down section. **0.15**

2.65 Dips reverse to west on right. Minor thrust(?) or overturned fold. **0.05**

2.7 Dips resume normal inclination to the east. **0.15**

2.85 Outcrops of dominantly shale sequence with minor crossbedded sandstone lenses. **0.05**

2.9 Outcrops of nodular to thick-bedded, light gray fossiliferous limestone dipping to the west. This unit continues to the southeast toward Angel Fire where it is apparently cut off by a high-angle normal fault (tear fault; see Colpitts and Smith, 1990). Here it is apparently cut by a low-angle thrust fault (Smith and Colpitts, 1980). The fault surface and associated structural features are exposed in a quarry above the road to the left. Petersen (1969) mapped this as a normal fault (down-to-the-west) although drag folding and angle of dip of the fault plane (45°) suggest that this is a thrust fault. Mapping of this feature southward by Smith and Colpitts (1980) supports this interpretation. This limestone unit was described by Casey (1980a) as a phylloid-algal-packstone carbonate bank that developed along the shallow eastern shelf of the Taos trough (Casey, 1980a). Exposures to the east were correlated with the upper Madera Limestone by Wanek and Read (1956) while those west of this fault are correlated with the Sandia Formation (Flechado Formation of Miller et al., 1963). Recent biostratigraphic correlations suggest that the strata east of this reverse fault are lower Desmoinesian based on the occurrence of *Beedeina* (*Fusulina*) cf. *B. taosensis* (Casey, 1980a). Smith and Colpitts (1980) noted the presence of *Anthracospirifer* cf. *A. rockymontanus* from the carbonate bed described above. This brachiopod is slightly younger than *B. taosensis* (Sutherland and Harlow, 1973) but corroborates a lower to middle Desmoinesian age for these rocks. **0.1**

3.0 Rocks dipping steeply to the east as highway curves to the right. **0.1**

3.1 Crossbedded sandstone channel to the right; dips are nearly vertical now. **0.3**

3.4 Summit of Palo Flechado Pass, elevation 9107 ft. Old stagecoach road entered pass at about 8:00, curved south slightly and went down the west side below the modern highway grade. Historical marker reads:

> Palo Flechado (tree pierced with arrows) was a pass much used by the Indians, Spaniards, and Anglos traveling from plains by way of the Cimarron River (called La Flecha—the arrow—in 1719). The Flecha de Palo Indians (Apache band) in 1706 inhabited the plains east of the mountains.

Turn right for STOP 1. The purpose of this stop is to examine the Pennsylvanian section east of the pass. **Park on the wide turn out** near the historical marker. Please use caution going down along the highway as motorists may not always see you around a curve. An alternative to examining outcrops along the highway is to follow the old stagecoach trail south of the road and examine outcrops there. Exposures are not as good, but you will be safer than you would be along the highway.

The outcrops along the highway were measured by Casey (1980a) as part of study of Pennsylvanian sedimentation and stratigraphy east of Taos. The sequence on the east side of the pass consists of interbedded gray brown, sandy, micaceous siltstones; calcareous greenish to light brownish gray, medium- to coarse-grained, micaceous subarkose; and gray to brownish gray carbonate wackestones, packstones and oolite grainstones with scattered marine fossils (brachiopods, crinoid ossicles, rugose corals, rare fusulinids). Casey (1980a, b) has interpreted these strata as having been deposited in the "eastern shelf facies" of the Taos trough (Rowe-Mora basin). Source for the sediment was apparently the Sierra Grande arch to the east; paleoflow was toward the west. The age of these rocks is apparently earliest Desmoinesian based on the occurrence of *Beedeina* (*Fusulina*) cf. *B. taosensis* documented by Young (1945) near the top of the sequence (foot of the pass to the east). This sug-

gests that the sequence correlates with Baltz and Myers' (1984) Porvenir Formation to the south. Depositional environments for these rocks include shallow terrigeneous shelf, carbonate bank, lobate delta and braided stream (Casey, 1980a, b). **Return to highway and continue drive to Taos. 0.2**

3.6 Coarse-grained, crossbedded sandstone, generally massive with shale partings and interbeds in these outcrops. **0.1**

3.7 Conglomerate zone in base of channel to right. Pebbles are predominantly quartzite and are generally well rounded suggesting a distant source for these rocks. **0.1**

3.8 Thin, nodular limestone on hill to right indicates probable channel abandonment in a lobate delta (Casey, 1980a). **0.2**

4.0 **Caution! Hairpin turn ahead at foot of pass. 0.1**

4.1 Outcrops at hairpin turn display massive, strongly jointed, crossbedded, coarse-grained sandstone (Fig. S-3.1). Forest Road 5 to right follows Tienditas Creek. Canyon is occupied by a high-angle fault with apparent down-to-the-east normal displacement. **0.1**

4.2 Outcrops to right and ahead consist of interbedded shales and coarse-grained sandstones of Pennsylvanian age dipping gently eastward. **0.1**

4.3 Outcrop in wash to right displays gently dipping Pennsylvanian strata. Old stagecoarch road now joins modern highway. Old grade up the pass is visible to the left at 9:00. **0.3**

4.6 Coarse-grained sandstone to right. Hillside to left at 8:00 to 11:00 mapped as Precambrian by Petersen (1969). **0.45**

5.05 Weathered shale and coarse-grained sandstone to right. **0.05**

5.1 Road to right. **0.8**

5.9 Road to right. **0.15**

6.05 Weathered coarse-grained sandstone in outcrop to right. **0.2**

6.25 Small pond at left. **0.35**

6.6 Small outcrop of yellowish sandstone in cut bank at 9:00. **0.35**

6.95 First occurrence of volcanic boulders from the "Carson Conglomerate" (Just, 1937) as we pass milepost 269. Road crosses a normal fault (down-to-the-east) that juxtaposes Tertiary volcaniclastics against Pennsylvanian (Flechado/Porvenir/Alamitos Formations, undivided) strata. Volcanic strata strike N68°W and dip 54°NE. Volcanic clasts include pebbles, cobbles and boulders of crystal tuff and andesite porphyry with occasional cobbles of vesicular basalt. **0.05**

7.0 **Pull off highway onto right shoulder for STOP 2.** The purpose of this stop is to examine outcrops of "Carson Conglomerate"/Picuris Formation. Although these rocks were correlated with the Carson Conglomerate by Just (1937), Kelley and Duncan (1984) suggested that they may correlate with the Picuris Tuff and possibly had their source in the eruptions related to formation of the Questa caldera. Work by Rehder (1986) on a similar sequence of strata in the Rancho de Taos–Vadito area suggests that these rocks belong to the Picuris Formation. Stratification of the material and rounding of the pebbles, cobbles and boulders in these outcrops indicates that the material was reworked and deposited by running water and/or debris flow (Fig. S-3.2). Source of the detritus is probably the Latir volcanic field (Rehder, 1986). Based on the lithologies of the cobbles, this sequence may correlate with Rehder's lower member of the Picuris Formation. **Continue drive toward Taos. 0.3**

7.3 Quarry in "Carson Conglomerate"/Picuris Formation to the right. **0.2**

7.5 Weathered "Carson Conglomerate"/Picuris Formation to right. **0.05**

7.55 Fault with normal displacement (down-to-the-east) separating "Carson Conglomerate"/Picuris Formation on the east from Pennsylvanian strata on the west. Outcrop of shale with conglomeratic sandstone channel immediately ahead. Pebbles are well-rounded quartzite and strata are flat lying. **0.05**

7.6 Road to right. Pennsylvanian strata exposed across valley at 9:00. **0.25**

7.85 Pennsylvanian strata exposed in slopes at 3:00. **0.3**

8.15 Rancho Baltz on right (Fig. S-3.3). Anonymous informed sources have it that this was a USGS field station during late Miocene time. The Survey apparently wanted to give it to Elmer in recognition of his many years working in this area and because it had a Pennsylvanian

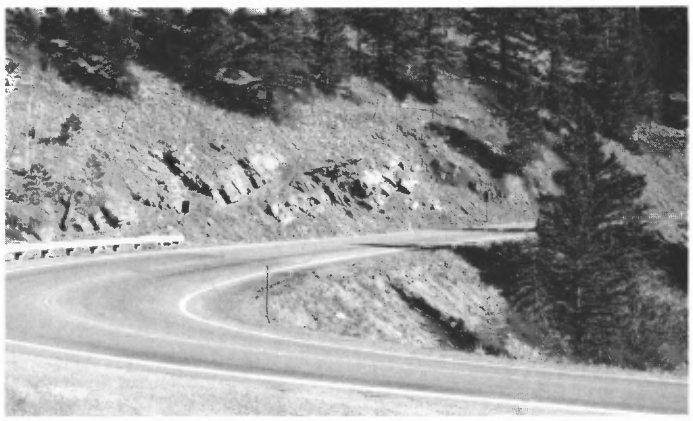

FIGURE S-3.1. Massive to medium bedded, coarse-grained channel sandstones surrounded by dark gray overbank and marine mudstones. Jointing caused by nearby normal fault with down-to-east displacement.

FIGURE S-3.2. Outcrop of Picuris Formation along U.S. Highway 64 at mile 7.0. Note even stratification in the sandstone, beds of boulder conglomerate and rounding of some of the boulders.

FIGURE S-3.3. "Rancho Baltz" with exposure of Pennsylvanian Porvenir(?) Formation in the distance.

FIGURE S-3.4. Quarry at Stop 3. Upper cliff is a coarse-grained channel sandstone with paleoflow apparently toward southeast. Channel underlain by dark gray marine shale at top of lower cliff. Lower cliff is a thick-bedded, fossiliferous wackestone deposited between active lobate deltas during Pennsylvanian time (Casey, 1980a, b).

outcrop nearby. These "sources" further state that Elmer refused; he preferred living out of the back of a pickup truck. **0.05**

8.2 **Pull off highway on right for STOP 3.** The purpose of this stop is to examine a quarry in Pennsylvanian strata that displays a re-established channel from a lobate delta (Casey and Scott, 1979) overlying fossiliferous carbonate wackestone (Fig. S-3.4). A specimen of *Beedeina* (*Fusulina*) *taosensis* (Needham) was collected and described by Needham (1937) either from this location or very near it. We found a specimen of the gastropod *Straparollus* sp. in the fossiliferous wackestone near the bottom of the exposure. The occurrence of *Beedeina* (*Fusulina*) *taosensis* indicates these rocks are earliest Desmoinesian and correlate with Baltz and Myers' (1984) Porvenir Formation. Approximately 2 mi east of this location east of the "Carson Conglomerate"/Picuris Formation exposures Needham collected a specimen of *Beedeina* (*Fusulina*) *euryteines* Thompson, which places those strata higher in the Porvenir Formation. Normal faulting most likely accounts for this occurrence of younger strata since the highway does not significantly rise through the Pennsylvanian section eastward toward Palo Flechado Pass. **0.1**

8.3 Taos Wagons West R-V Park at 10:00. **0.3**

8.6 Forest Road 437 to left. Limestone outcrop above road indicates delta lobe abandonment and re-establishment of marine conditions along the Pennsylvanian shoreline (Casey and Scott, 1979; Casey, 1980a, b). **0.3**

8.9 Sandstone outcrop to right in roadcut. **0.3**

9.2 Dark gray shale to right in roadcut. **0.2**

9.4 Roadcuts ahead expose shale with thin calcareous zones and sandstone beds. These may be part of a marine prodelta sequence. Section above this in slopes to the right is dominantly shale. **0.55**

9.95 Milepost 266. **0.05**

10.0 Dark gray mudstone, shale and siltstone exposed in roadcut. **0.8**

10.8 Laguna Verde to left. **0.6**

11.4 Cliff to right as we come around the curve is composed of a channel sandstone (medium- to fine-grained, angular to subangular, well-sorted quartz sand grains) that is thin-bedded and crossbedded. These channels are locally common and are surrounded by noncalcareous shales and siltstones of fluvial origin (Casey, 1980a). Loma Verde immediately ahead and to the left. **0.3**

11.7 Nodular bedded carbonate underlain by sandstone and shale possibly belonging to the Porvenir Formation. **0.15**

11.85 Forest road to left. **0.05**

11.9 Milepost 264. **0.3**

12.2 Small cliff at 1:00 at midslope is thickly to thinly laminated black calcareous shale showing small-scale slump folding. This is evidence of prodelta soft-sediment deformation that developed during a progradational event in Pennsylvanian time. **0.2**

12.4 Outcrops mostly shale now. Small-scale soft-sediment deformation in outcrop to right. **0.2**

12.6 Outcrop of carbonaceous shales with crossbedded channel sandstones, crevasse splay deposits and lignite partings in the mudstones and shales. Beds dip southward. **0.3**

12.9 Outcrops of massive sandstone with shale partings. **0.35**

13.25 Outcrops of massive sandstone with shale partings. **0.2**

13.45 Dips becoming steeper to the southeast. **0.25**

13.7 Entering the booming metropolis of Shady Brook. **0.3**

14.0 La Sombra Campground (U.S. Forest Service) ahead. Milepost 262. **0.2**

14.2 Dips in Pennsylvanian strata are horizontal again. **0.2**

14.4 Sandstone forms ledges in slopes to right. **0.1**

14.5 Capulin Campground (U.S. Forest Service) to the left. **0.1**

14.6 Outcrops of sandstone dipping gently west. **0.25**

14.85 Forest Road 10 to right leads to Shadow Mountain Ranch resort. **0.15**

15.0 Taos Creek Cabins on left. **0.2**

15.2 Entering developed area of summer cabins and year-round housing. **0.3**

15.5 Poorly exposed Pennsylvanian Flechado (Sandia) or Porvenir Formations in roadcut. Slopes are covered with trees. **0.4**

15.9 Milepost 260. **0.05**

15.95 Road to Ranch Canyon on right. **0.25**

16.2 Flat-lying Pennsylvanian sandstone and shale exposed in hillside above road to right. **0.7**

16.9 Milepost 259. **0.1**
17.0 Wide turnout to right. Interbedded sandstone and shale of Flechado (Sandia) or Porvenir Formations exposed in hills to right and ahead. Outcrops ahead are a monotonous sequence of sandstone, shale and minor limestones of prograding deltas and foreshore muds along the western shoreline of the Taos trough (Casey, 1980a, b). **0.2**
17.2 Las Petacas picnic grounds to the left. **0.3**
17.5 Bold channel sandstone in slope above road. **0.2**
17.7 Shale outcrop to right. **0.2**
17.9 Milepost 258. **0.4**
18.3 La Vineteria picnic grounds. Outcrop ahead has sandstone and shale with minor limestone or calcareous zones in the shale. **0.25**
18.55 Crossbedded channel sandstone exposed in roadcut to right. **0.05**
18.6 El Nogal picnic ground to left. **0.1**
18.7 Leaving Carson National Forest. **0.2**
18.9 **Junction** with NM-585 at left. The fault marking the east side of the Rio Grande rift lies several hundred yards ahead. Continue straight ahead to go to Taos or turn left to take the bypass around town.

End of Supplemental Road Log 3.

SUPPLEMENTAL ROAD LOG 4, FROM US-64 UP PONIL CANYON TO THE NORTH PONIL K-T BOUNDARY SITE

CHARLES L. PILLMORE

Distance: 17 mi
Stops: 1

The North Ponil K-T boundary site is on Philmont Scout Ranch private property. Special permission is required prior to taking this trip.

Mileage

0.0 From mile 104.5 of Day 1 road log, just east of Cimarron on US-64, **turn north** up Ponil Canyon. **2.7**
2.7 **Chase Ranch,** prominent historical landmark in the region. In 1869, Manley Chase purchased "about a thousand acres" in Ponil Valley from Lucien Maxwell for $2.50/acre (Armstrong, 1981). He paid for the land by rounding up wild horses valued at $10.00 each. He started the first four rooms of the present ranch house in 1871. Additions were made on the house at various times since. Manley Chase died in 1915. The ranch is presently owned and operated by his great granddaughter, Gretchen Sammis. **1.1**
3.8 At 9:00, prospect in Cimarron coal bed between the upper and lower tongues of the Trinidad Sandstone. **0.4**
4.2 Entrance to Chase Canyon. Note old coal mine workings in Cimarron coal bed in south wall of canyon near entrance. **0.6**
4.8 Cimarron coal bed, 29 in. thick, exposed in roadcut. Upper bed of the Trinidad Sandstone containing *Ophiomorpha* overlies coal bed. Vermejo Formation overlies upper tongue of Trinidad Sandstone as we travel up section. **0.4**
5.2 Roadcut exposes typical gray mudstone, carbonaceous siltstone and shale and sandstones of the Vermejo Formation. **0.6**
5.8 **Cattleguard** on fence of Philmont Scout Ranch. Ahead are cliffs of the barren zone. K-T boundary is at base of the sandstone sequence. **0.2**
6.0 Junction of North Ponil Canyon. **Locked gate.** Entrance to Ponil Canyon part of Philmont Scout Ranch. Raton Formation conglomerate forms ledges about 40 ft above valley floor on ridge to the east. In this area the ledges are formed by fine-grained to granule sandstone. As we proceed up North Ponil Creek, sandstone of the lower coal zone of the Raton Formation crops out along road and in roadcuts. Road follows old Ponil Canyon Railroad grade. **2.2**
8.2 Thick channel sandstones of the Raton Formation barren zone can be seen on the valley walls, dipping gently north. **0.3**
8.5 North Ponil K-T boundary site in stream bank at 9:00. K-T boundary claystone appears as thin white claystone layer overlain by thin coal bed in carbonaceous sequence. The following is a generalized section: (1) 3.2 ft, siltstone; (2) 0.98 ft, mudstone; (3) 0.68 ft, coal; (4) 0.2 in., shale; (5) 0.03–0.07 in., K-T boundary claystone—light to medium gray, some iron stains, conchoidal fracture, weathers distinctive white to pinkish gray; (6) 1.2 ft, shale—basal 2 cm jarosite stained; (7) 2.8 ft, mudstone and sandstone.

Return to Ponil gate and return to highway.

End of Supplemental Road Log 4.