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GEOLOGICAL SURVEY

ROAD LOG AND TRIP GUIDE TO THE GEOLOGY OF THE NORTHERN PIÑON RANGE AND VICINITY, NORTH-CENTRAL NEVADA

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By

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INTRODUCTION

This road log has been prepared as a guide to Field Trip 2 (September 13, 1979) for the GSA-sponsored Penrose Conference on "The Antler Orogeny--mid-Paleozoic tectonism in Western North America." Field Trip 2 will visit the northern Piñon Range in north-central Nevada (fig. 1) to examine critical evidence for dating the Roberts Mountains thrust in this area (Smith and Ketner, 1968) and to examine the sedimentary features and depositional environments of the flysch that was deposited in a trough along the western margin of the Antler foreland basin, and which overlapped the eastern margin of the Antler orogenic belt (Poole, 1974; Smith and Ketner, 1975; Poole and Sandberg, 1977). Of ten stops scheduled, all involve short walks to examine Paleozoic sedimentology, stratigraphy, and structure relevant to evaluating Antler orogenic activity and attendant flysch sedimentation. See U.S. Geological Survey Map I-1028 (Smith and Ketner, 1978) for geologic setting of the Carlin-Piñon Range area. Figure 2 is a stratigraphic chart of Paleozoic rocks exposed in the northern Piñon Range and vicinity.

The first stop will be to closely examine a roadcut composed of Lower and Middle Pennsylvanian Tomera and Moleen Formations (undivided). Here we will see marine beds of detrital limestone and fine- to coarse-grained siliceous sediments derived from final uplifts of the Antler orogenic highland to the west.

The second stop will be a distant view of the angular unconformity between nearly vertical beds of the Mississippian and Lower Pennsylvanian Diamond Peak Formation overlain by steeply dipping beds of the Upper Pennsylvanian and Permian Strathearn Formation. This unconformity represents regional deformation of late Middle Pennsylvanian age and post-dates the Antler orogeny. This stop will also include close examination of a roadcut exposing coarse detritus of a subsea fan in the lower part of the Diamond Peak Formation.

The third stop will include a discussion of surrounding geology followed by close examination of the overlapping autochthonous Lower Mississippian Webb Formation lying unconformably on allochthonous Ordovician Vinini Formation of the upper plate of the Roberts Mountains thrust.

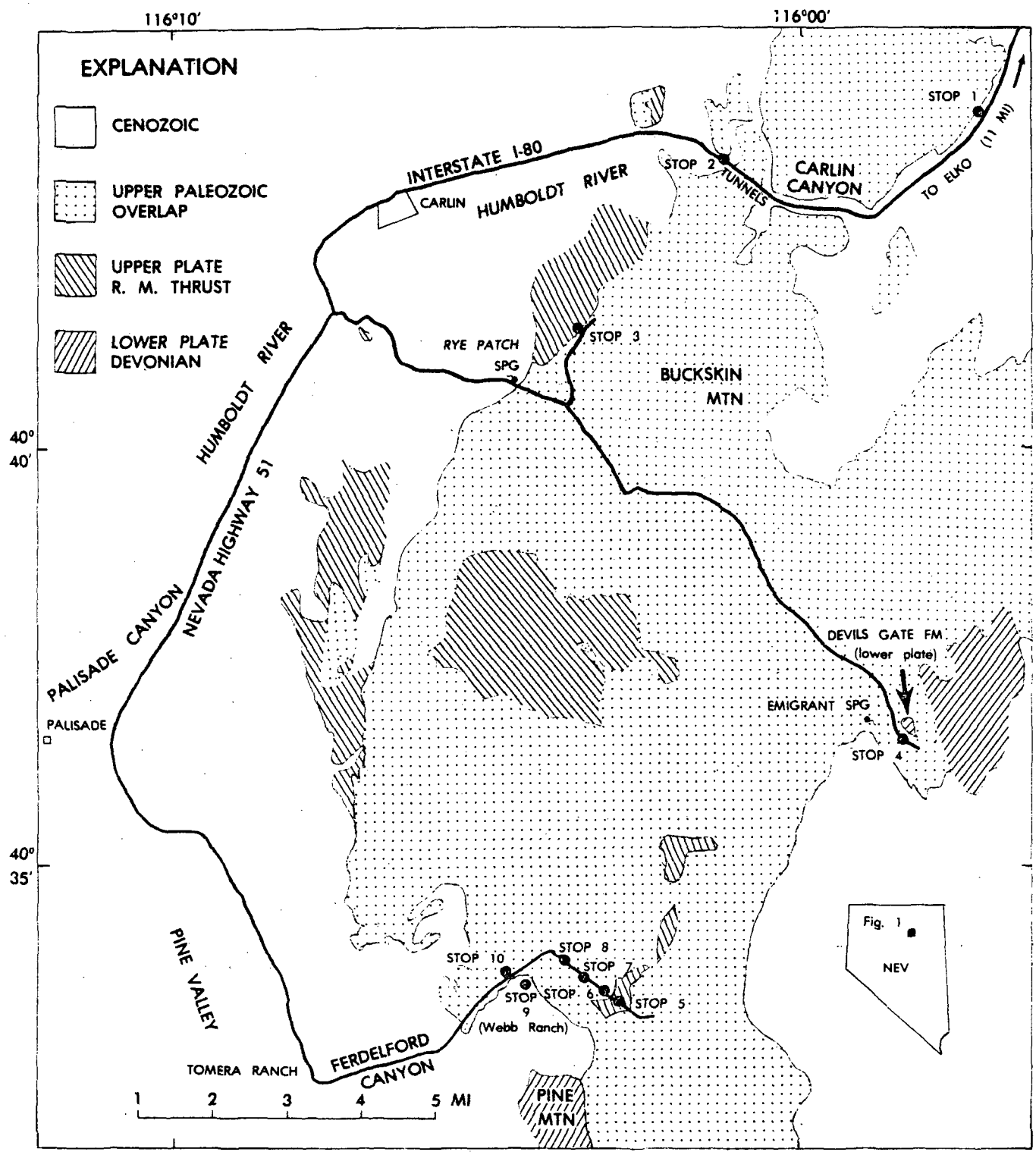

Figure 1.-- Sketch map of northern Piñon Range showing principal rock assemblages and route of Field Trip 2. Geology generalized from Smith and Ketner (1978)

AGE	OVERLAP SEQUENCE, POST-ROBERTS MOUNTAINS THRUST	
PERMIAN	Unnamed units (limestone, siltstone, sandstone, chert, and phosphorite). Strathearn Formation (detrital limestone with beds of quartz- and chert-clast sandstone and conglomerate)	
PENNSYLVANIAN	Tomera Formation (chert- and quartzite-pebble conglomerate with detrital limestone beds) Moleen Formation (limestone with conglomeratic beds similar to those in the Tomera)	
MISSISSIPPIAN	Diamond Peak Formation (mainly conglomerate and sandstone composed of chert and quartzite clasts but with shale beds similar to those in the Chainman Shale). The term Diamond Peak has priority over the term Tonka of Dott (1955) and is now widely used Chainman Shale (mainly shale but with beds of sandstone and conglomerate similar to those in the Diamond Peak) Webb Formation (siltstone and sandstone mainly of quartz and chert grains; thins and fines southward)	
	UPPER PLATE OF ROBERTS MOUNTAINS THRUST	LOWER PLATE OF ROBERTS MOUNTAINS THRUST
DEVONIAN	Woodruff Formation (mudstone, chert, and dolomitic siltstone)	Devils Gate Limestone Nevada Formation (limestone, dolomite, and quartzite)
SILURIAN	Unnamed units (siltstone, novaculite, and chert)	Lone Mountain Dolomite
ORDOVICIAN	Vinini Formation (shale, chert, limestone, and sandstone)	Hanson Creek Formation (limestone dolomite, and quartz sandstone) Eureka Quartzite Pogonip Group (limestone, dolomite, and shale)

Figure 2.--Paleozoic rocks exposed in the field trip area, northern Piñon Range.

The fourth stop is to examine overlapping autochthonous Webb Formation lying unconformably on autochthonous Upper Devonian Devils Gate Limestone (eastern carbonate assemblage) east of the leading edge of the Roberts Mountains thrust. The third and fourth stops provide an example of the principal evidence for dating the emplacement of the Roberts Mountains allochthon in this area.

The fifth stop will be to examine the very Late Devonian part of the Woodruff Formation in the Roberts Mountains allochthon.

The sixth stop will be to closely examine overlapping autochthonous siliceous fine-grained Webb Formation that rests on allochthonous Woodruff Formation of stop 5.

The seventh stop will be to examine a flysch unit of gravelly mudstone and sandstone in the lower part of the Lower Mississippian Chainman Shale deposited in the flysch trough. Here we will see a variety of source-terrane rock types represented by gravels derived from the Antler highland to the west.

The eighth stop will be to examine sandstone turbidites and associated mudstones of the Chainman Shale deposited in the flysch trough.

The ninth stop will be a distant view of a submarine channel cut into Chainman Shale and filled with sand and gravel of the basal Diamond Peak Formation.

The tenth stop will be to closely examine detached sandstone and conglomerate blocks of Diamond Peak Formation that occur in the channel fill which forms cliffy outcrops north of the road. Here we will see bedding features and source-terrane rock types of detritus deposited in a Lower Mississippian submarine canyon.

ROAD LOG AND TRIP GUIDE

(SECOND FIELD TRIP--SEPTEMBER 13, 1979)

Elko to Ferdelford Creek via Carlin Canyon, Rye Patch, and Emigrant Springs

Trip Leaders: Keith B. Ketner and Forrest G. Poole

Distance	Cumulative mileage	Description
0.0	0.0	Leave Holiday Inn parking lot at 7:30 a.m.; drive west toward downtown Elko.
0.9	0.9	Pony Express station on right.
0.7	1.6	Elko County courthouse on right. Downtown Elko.
0.8	2.4	Junction with Nevada Highway 51 on right.
0.2	2.6	Elko airport on right. At 9 o'clock, in canyon south of town are exposures of oil shale beds in Oligocene(?) and Eocene Elko Formation and ruins of Catlin retort.
0.8	3.4	On right skyline is Adobe Range and on left skyline are Elko Hills--both composed largely of Mississippian and Pennsylvanian Diamond Peak Formation.
2.0	5.4	Terraces on right are formed on Miocene deposits.
0.4	5.8	Divided highway begins.
1.1	6.9	Roadcuts on right expose Miocene deposits.
0.9	7.8 (MP 296)	Peak on skyline at 10 o'clock is Grindstone Mountain composed of Pennsylvanian Moleen Formation. Bluffs in foreground composed of Mississippian and Pennsylvanian Diamond Peak Formation and Permian rocks.

1.0	8.8 (MP 295)	Canyon at 9 o'clock is South Fork of Humboldt River where Donner party emerged late in 1846 following a disasterous misguided detour around the south end of Ruby Mountains. This delay caused the party to reach the high Sierra Nevada too late in the year to avoid heavy snow. Only a few survivors reached the Sacramento Valley the following spring.
1.4	10.2	Roadcuts on right expose upper Miocene Humboldt Formation composed largely of continental volcaniclastic sediments.
1.0	11.2	Hunter exit on right.
2.4	13.6	Roadcuts on right expose Pennsylvanian and Permian rocks composed of siltstone, sandstone, limestone, and dolomite.
0.5	14.1	Hills and bluffs on right composed of Pennsylvanian and Permian rocks.
0.7	14.8	STOP 1. Park on right shoulder of Interstate 80. Examine roadcut on right (north) composed of Lower and Middle Pennsylvanian Tomera and Moleen Formations (undivided). Outcrop consists of detrital limestone and fine- to coarse-siliceous sediments derived from final uplifts of Antler orogenic highland to west.
0.9	15.7	Prominent tan cliffs on right encrusted with swallow nests consist of limestone-gravel conglomerate of probable Eocene age.

0.4	16.1 (MP 288)	Enter Carlin Canyon where antecedent Humboldt River crosses Piñon Range. Trappers and Indian traders entered Carlin Canyon for the first time about the year 1828. This route was used subsequently by most parties going to California both before and after gold was discovered there in 1849. Chinese track gangs built the first railroad (Central Pacific, now Southern Pacific) through the Canyon in 1868, and a second (Western Pacific) was built in 1907. The first highway opened this route to automobiles in 1913.
0.1	16.2	Steeply dipping beds at 12 o'clock are rocks of Pennsylvanian age similar to those seen at stop 1.
0.9	17.1	Cross Humboldt River. Cliffs on the right are same Pennsylvanian formations.
0.2	17.3	At 9 o'clock, prominent gray limestone cliff is basal unit of Pennsylvanian Moleen Formation resting with normal sedimentary contact on brown slope-forming Diamond Peak Formation. Red beds at 9 to 11 o'clock are uppermost Diamond Peak Formation of Mississippian and Pennsylvanian age.
0.4	17.7	At 11 to 12 o'clock above railroad tunnels is an unconformable contact between gray Pennsylvanian and Permian Strathearn Formation on the right and red-brown Diamond Peak Formation on the left.
0.3	18.0	Tonka siding at 9 o'clock.
0.4	18.4	Cross Humboldt River and enter tunnel.
0.4	18.8	Emerge from tunnel and cross Humboldt River.

0.2	19.0	STOP 2. Park cars north of Interstate 80 near outcrop. Walk east for view northward of angular unconformity between nearly vertical red and brown Diamond Peak Formation below and steeply dipping gray Strathearn Formation above. This unconformity represents regional deformation of late Middle Pennsylvanian age. The deformation post-dates the Antler orogeny and has been termed the Humboldt orogeny by Ketner (1977). Tan beds in saddle contain fossils that date them as approximating the Lower and Upper Mississippian boundary. The thicker-bedded Diamond Peak strata below (west of) the fossiliferous unit comprise a submarine fan system, whereas the thinner-bedded Diamond Peak strata above (east of) the fossiliferous unit comprise a delta system. Outcrops nearby next to the parked cars are the lower part of the Diamond Peak Formation and consist of coarse detritus derived from the nearby Antler highland to the west. Massive bedding and poor sorting of sand and gravel suggest debris-flow and grain-flow deposits of an upper subsea fan (Poole, 1974). Examine normal and inverse graded bedding, sole markings, and trace fossils. Clasts are composed of chert, quartzite, sandstone, and argillite set in a sandy and silty matrix composed of quartz and chert grains. The clasts were apparently derived from the Roberts Mountains allochthon as these lithologies are the most abundant in the allochthon. The coarse detritus and bedding features indicate close proximity to source terrane.

0.1	19.1	Divided highway ends. At 9 o'clock, across the river is a fault separating Diamond Peak Formation on the east and Lower Mississippian Webb Formation on the west. The Webb forms smooth slopes, and Diamond Peak forms rugged outcrops. The Webb Formation is the oldest formation in this area composed of Antler orogenic debris.
1.0	20.1	At 3 o'clock, well-exposed reddish lowermost Mississippian Webb Formation (west) resting on poorly exposed Ordovician Vinini Formation (east).
0.9	21.0	Building on left is an old mill once used in processing diatomite that was mined from lake beds in Miocene Humboldt Formation north of highway.
1.3	22.3	Marys Mountain at about 1 o'clock composed almost entirely of upper-plate western facies rocks of Ordovician, Silurian, and Devonian age.
0.8	23.1	Cross Maggie Creek. Large building at 9 o'clock adjacent to railroad tracks is an old railroad ice house. Ice cut from nearby ponds was stored here to stock refrigerator cars.
0.7	23.8	Enter town of Carlin, Nevada, turn left at State Inn Cafe and then at 0.1 mile turn right onto Nevada Highway 51.
1.0	24.8	Leave Carlin.
0.2	25.0	Carlin Spring on the right, under metal roof, was gathering place for 49'ers enroute to California. It was necessary for them to depart temporarily from Humboldt River Valley at this point because of the narrow and rocky Palisade Canyon downstream.

0.8	25.8	Cross Southern Pacific Railroad and Humboldt River.
0.7	26.5	Cross Western Pacific Railroad. Make abrupt left turn (east).
0.4	26.9	Bear right after crossing cattle guard onto old Pine Valley road leading up Woodruff Creek Valley.
0.4	27.3	Sharp left turn. Southeast of road junction is a small ledgy outcrop of Ordovician Vinini Formation. Road to Rye Patch Spring (next 3.6 miles) crosses Miocene Humboldt Formation.
0.3	27.6	Bear right at fork in the road. Top of terrace.
3.1	30.7	Rye Patch Spring on left.
0.2	30.9	Scree slope at 9 to 12 o'clock composed of Webb Formation.
0.5	31.4	Cross poorly exposed Mississippian rocks.
0.1	31.5	Boulders and cobbles of Quaternary alluvium litter slope on left.
0.2	31.7	Sharp left turn onto jeep trail.
1.3	33.0	STOP 3. Park on ridge crest. Discussion of surrounding geology followed by short hike to examine Lower Mississippian Webb Formation and underlying Ordovician Vinini Formation. Ridge under foot is composed of Webb Formation, strike valley to southeast is formed on Lower Mississippian Chainman Shale. Buckskin Mountain to southeast is capped by Pennsylvanian and Permian rocks overlying Diamond Peak Formation. The Webb Formation, a chert-grain siltstone unit, locally is the oldest formation composed of Antler orogenic debris. Here it lies unconformably on the Vinini Formation, a chert and shale unit of the Roberts Mountains allochthon. At the next stop, we will see the Webb Formation lying unconformably on the Devonian Devils Gate

		Limestone, an autochthonous carbonate unit. The leading edge of the Roberts Mountains allochthon lies buried under upper Paleozoic rocks between stops 3 and 4. Return to main road.
1.2	34.2	Junction with main road, turn left.
0.5	34.7	Ledges at 12 o'clock composed of Diamond Peak Formation.
0.3	35.0	Cross Diamond Peak Formation.
0.1	35.1	Outcrops on left are conglomerates of Diamond Peak Formation.
0.7	35.8	Bear left after sharp left turn. Buckskin Mountain is visible ahead with the Diamond Peak Formation at its base and the Pennsylvanian and Permian Strathearn Formation above. Younger Permian rocks are at the very top.
1.1	36.9	Road junction. Continue straight ahead.
0.5	37.4	Cattle guard.
0.6	38.0	Cattle guard and gate. Last person close gate.
0.3	38.3	Unnamed spring on the left.
0.7	39.0	Drainage divide.
0.3	39.3	By now, we have probably crossed the buried leading edge of the Roberts Mountains allochthon.
0.1	39.4	Cross contact between Diamond Peak Formation on left and underlying Chainman Shale on right.
1.7	41.1	The smooth gray slopes ahead are Chainman Shale, and the rough brown outcrops are Webb Formation. The Webb overlaps Devonian eastern facies carbonate rock at the top of the hill.
0.3	41.4	Chainman Shale exposed on right at bend in the road.
0.1	41.5	Road on right leads to Emigrant Spring. Continue south on the main road.

0.1	41.6	Brown outcrops on left are composed of Webb Formation.
0.3	41.9	STOP 4. Park in saddle. Walk north back along road to gulch on right. Road nearly coincides with Webb-Chainman contact. Hike east down gulch to view the overlapping autochthonous Webb Formation lying unconformably on the autochthonous Devils Gate Limestone. We have now seen an example of the principal evidence for dating the emplacement of the allochthon in this area. The Webb Formation is earliest Mississippian in age, and the Devils Gate Limestone is latest Devonian in age. The youngest rocks in the allochthon are very Late Devonian in this area. Therefore, the Roberts Mountains thrust in this area is of latest Devonian or earliest Mississippian age. Return to cars for lunch. After lunch, drive back to Highway 51 (13 miles).
13.0	54.9	Junction with Highway 51. Turn left (south). The present highway is not shown on the Carlin topographic sheet.
1.0	55.9	Brown rugged outcrops at 12 to 3 o'clock are composed of upper Miocene Palisade Canyon Rhyolite. Humboldt River cuts through rhyolite forming rugged canyon that forced the 49'ers to detour north of the canyon at Carlin Spring. Rhyolite also forms dip slope east of the highway.
3.0	58.9	Light-colored outcrops at 3 o'clock just above the valley floor consist of upper Miocene Humboldt Formation.
0.7	59.6	Roadcuts along highway expose Palisade Canyon Rhyolite.

2.6	62.2	Road to right leads to townsite of Palisade. Lead and silver ores from the Eureka Mining District were shipped north to Palisade on the Eureka and Palisade (narrow gauge) Railroad between 1875 and 1938. The rails of this railroad were torn up and shipped abroad just prior to World War II, but the road bed and trestles can still be seen in Pine Valley.
0.5	62.7	Dam and reservoir in Pine Creek on right. Enter Pine Valley. Oligocene tuff and tuffaceous sediments on right. Younger landslide mass on the left is composed largely of volcanic debris.
0.4	63.1	Pine Mountain in the distance at 1 o'clock.
1.2	64.3	Road on left leads to Cole Creek and was part of the old highway route from Eureka to Carlin.
0.2	64.5	At 3 o'clock, light-colored outcrops are tuff.
0.4	64.9	Drab outcrops on both sides of highway are composed of Humboldt Formation. Remnants of old narrow-gauge railroad bed of Eureka and Palisade Railroad can be seen on the flood plain of Pine Creek.
1.6	66.5	Light-colored tuffs and sediments in low hills on the left comprise the Pliocene and Pleistocene Hay Ranch Formation.
1.0	67.5	Tomera Ranch on right. Grove of trees west of the ranch was old railroad station originally called Paddlefred.
0.2	67.7	Turn left onto dirt road leading up Ferdelford Creek Valley. Hay Ranch Formation on both sides of valley.
0.1	67.8	Pine Mountain in distance ahead consists of lower-plate Devonian rocks exposed in a window very close to the leading edge of the Roberts Mountains allochthon.

2.2	70.0	Yellowish siltstone and fine-grained sandstone crop out at 11 to 12 o'clock and are the "Ferdelford fossil beds" within the Diamond Peak Formation. The fauna nearly coincides with the Lower-Upper Mississippian boundary. Pine Mountain at 3 o'clock.
0.4	70.4	"Ferdelford fossil beds" at 9 o'clock. Cliffy outcrops forming canyon walls at 11 to 1 o'clock composed of Diamond Peak Formation.
0.5	70.9	Cliffy outcrops of Diamond Peak Formation at 11 o'clock represent a submarine channel fill. Channel is cut into Lower Mississippian Chainman Shale that forms a smooth slope below cliffs.
0.5	71.4	Abandoned Webb Ranch at 3 o'clock. Mr. Webb was a popular 19th century author of stories and accounts of the wild west.
0.5	71.9	Road on left (east) leads into valley of mainly Chainman Shale capped by basal conglomerate of the Diamond Peak Formation. Bear right and remain on main road up unnamed tributary.
0.1	72.0	Outcrops in roadcut on left are Chainman Shale. To be examined on return.
0.3	72.3	Outcrops on left are Chainman Shale.
0.3	72.6	Gravelly mudstone and sandstone crop out on left. To be examined on return.
0.1	72.7	Outcrop in roadcut is bedded gravelly sandstone.
0.3	73.0	Gully on left at 9 o'clock is approximate position of contact between Lower Mississippian Webb Formation below (south) and Lower Mississippian Chainman Shale above (north).
0.1	73.1	Webb Formation exposed left (east) of road forms platy gray and white talus. To be examined on return.

0.2	73.3	Devonian Woodruff Formation of Roberts Mountains allochthon exposed along road on left and right.
0.3	73.6	Mesozoic(?) thrust contact in roadcut on left. Woodruff (west) is thrust over Chainman (east).
0.3	73.9	Cattle guard. Spring on left.
0.1	74.0	Turn around and head back down canyon. Pine Mountain at 10 o'clock.
0.1	74.1	Cattle guard.
0.2	74.3	Mesozoic(?) thrust on right. Woodruff Formation visible in roadcut northwest of thrust.
0.3	74.6	STOP 5. Park cars along road. Examine platy tan siltstone talus slopes on right across the wash. This unit is the very Late Devonian part of the allochthonous Woodruff Formation.
0.1	74.7	Roadcut on left is Woodruff Formation.
0.2	74.9	STOP 6. Park cars along road. Examine Webb Formation east of road. The Webb here is a thin-bedded dark-colored sequence of platy siliceous argillite, siltite, and chert- and quartz-grain quartzite. The Webb and Woodruff are difficult to separate here owing to their locally similar lithologies.
0.1	75.0	Gully on right (east) contains Webb-Chainman contact.

0.3	75.3	STOP 7. Park cars along road. Examine gravelly sandstone and mudstone. This is part of a widespread submarine debris flow in the lower part of the Chainman Shale. The clasts include subrounded to well-rounded pebbles, cobbles, and boulders of chert, argillite, siltite, fine- to coarse-grained quartzite, grit, pebbly and gritty quartzite, limestone, dolomite, greenstone, etc. The most common clasts are chert, argillite, siltite, fine-grained quartzite, carbonate rocks, and greenstone. Some unique clasts are limestone gravels containing oncolites (Girvanella?) of probably shallow-water origin and gritty and pebbly quartzite gravels similar to lithologies in the Cambrian Harmony Formation now exposed 50 to 100 miles west of here. Poole and Ketner are studying clast lithologies in order to correlate them with rock sequences in the allochthon to the west. Unsorted gravelly mudstones and siltstones may have originated from rapid deposition of sand and gravel on top of water-saturated mud that subsequently moved downslope forming a chaotic mixture of mud, sand, and gravel (Poole, 1974). These deposits reflect unstable slope conditions.
0.6	75.9	STOP 8. Park cars along road. Examine sandstone turbidites and adjacent mudstones of the Chainman Shale. Note sole markings, current structures, and trace fossils; abundant wood impressions occur in some sandstone beds.
0.1	76.0	Turn left on road leading to Webb Ranch.

0.3	76.3	STOP 9. Park cars along road. Hike west across wash and onto ridge south of ranch to view submarine channel cut into Chainman Shale exposed on north side of Ferdelford Canyon. Coarse debris (sand and gravel) of basal Diamond Peak Formation fills the channel. See Poole (1974, fig. 6) for description of channel-fill units. The southeast-trending channel is about 1,000 feet wide and 500 feet deep. Return to main Ferdelford road following stop.
0.4	76.7	Junction with main road; turn left (north).
0.4	77.1	STOP 10. Park cars along road. Examine rock-fall blocks of Diamond Peak Formation sandstone and conglomerate along road. These lithologies occur in the channel fill. Following stop, return to Holiday Inn (43 miles).

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