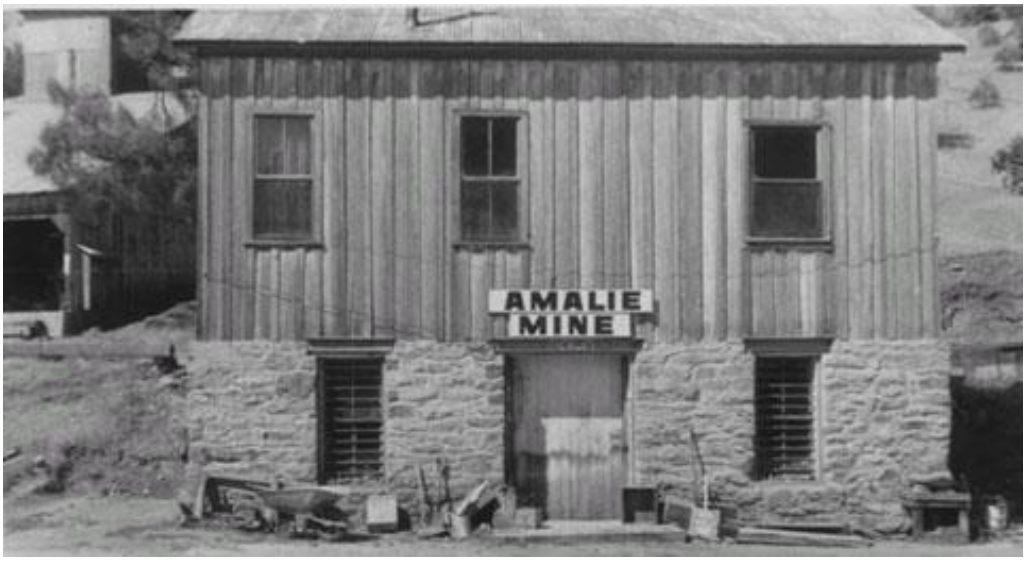
# FIELD GUIDE

# GEOLOGY AND MINING HISTORY OF THE KERN CANYON, LAKE ISABELLA AND WALKER BASIN, KERN COUNTY CALIFORNIA

**Gregg Wilkerson**
**2017**




**Acknowledgements**

This field guide is adapted from field guides produced by the Buena Vista Museum of Natural History and the U.S. Bureau of Land Management from 1993 through 2003. Almost all of the mine descriptions in this field guide are adapted from those found in the Troxell and Morton (1968) report on the "Mines and Mineral Resources of Kern County."

**Field Trip Overview**

This field trip leaves the Coseree's Deli parking lot at 8:15 a.m. We then take High-way 178 up through the Kern Canyon to Lake Isabella. After visiting sites around the lake we take the Havilah-Bodfish road south toward Walker Basin. We visit the museum in Havilah and return to Bakersfield through Twin Oaks on Caliente Creek. Participants should all bring water and a sack lunch.

## Contents

# ROAD LOGS

## PART 1: BAKERSFIELD TO LAKE ISABELLA

### AREA MAP 01

0.0 Beale Library Parking Lot. Go out of the parking lot to "S" street. Turn LEFT on "S" street to Truxtun Ave. Turn LEFT onto Truxtun Avenue and go west to "Q" Street.

0.1 Intersection of Truxtun Avenue and "Q" Street. TURN RIGHT on "Q" Street head north to Highway 178.

0.8 Highway 178 and "Q" street. TURN RIGHT at Golden State Avenue, immediately enter the circular on ramp and head east toward Isabella on Highway 178.

The rocks beneath us are marine sediments of Pliocene and Pleistocene age. These names refer to geologic ages (see Figure 1). The sediments were washed into this area from the ancestral Sierra Nevada Mountains.

The San Joaquin Basin is over 30,000 feet deep, containing sediments of at least Cretaceous to Recent age (Figure 2). The valley was once a great inland sea basin that was inundated or flooded periodically. As the basin sank, sediments from the rising mountains to the east (ancestral Sierra Nevada) and lessor amounts from the west accumulated in the valley. This sinking was due both to the weight of sediment and from compressive forces between the North American and Pacific continental plates.

Geologists that study sequences of rock strata are called stratigraphers. The science is based on two principles identified in 1669 by Nicholas Steno, an Italian physician. The principles are called the Principle of original Horizontality and the Principle of Superposition.

The first principle states that rock layers are originally laid down in a horizontal position. The second principle states that in an undisturbed sequence of rocks, the oldest are on the bottom and the youngest are on top. Using this science,

stratigraphers have identified many mappable rock layers in the Southern San Joaquin Valley and other regions.

By correlating rock layers of similar type and age around the world, geologists have built up the "Geologic Column", a generalization about the age relationships of rocks of the earth's crust (Figure 1).

Geologists have found that each rock layer has an unique assemblages of fossils. In general, older fossils are smaller and simpler, younger fossils appear more like modern living forms and generally are more complex. By studying the fossils, determinations can be made where a rock layer would fit into the Geologic Column. In this way, relative ages for the sequence rocks can be determined.

5.8 Fairfax Road intersection.

6.7 Road cut in Pleistocene gravels of the Kern River Formation at Morning Drive. These gravels are known to contain small amounts of gold. The stratigraphic relationships between this and other sedimentary units in this area are illustrated in Figures 4, 5, and 6.

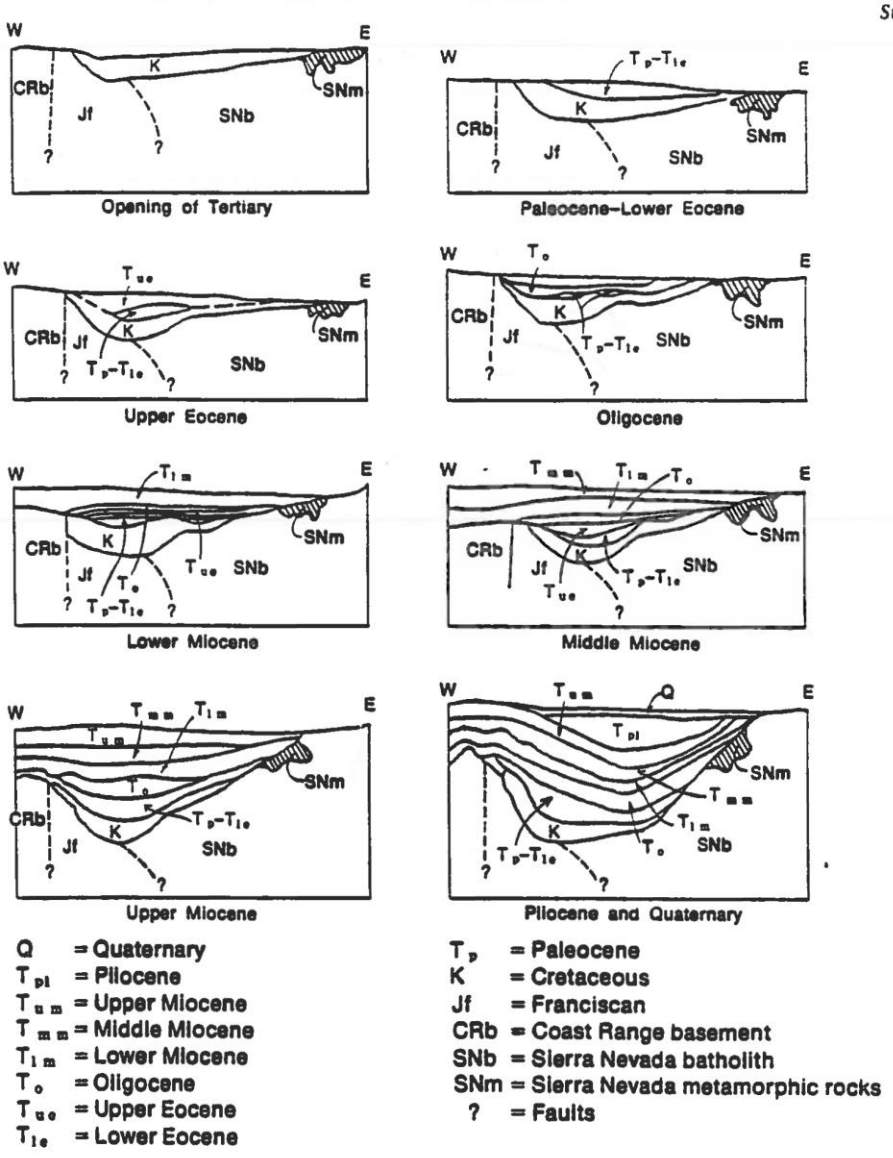
These same gravels are at the site of the old city dump. (The overhanging condominiums of Park Place now look at this area). The Omar Hill co-generation plant also rests on this gravel bed. Some of these developments may be built atop gold deposits. No systematic survey has yet been published for them.

Most of the land in Kern County was originally patented and developed as agricultural land. Little gold mining activity has occurred outside of the mountainous and desert areas of the county.

## GEOLOGICAL TIME SCALE
## (In use by the U. S. Geological Survey)

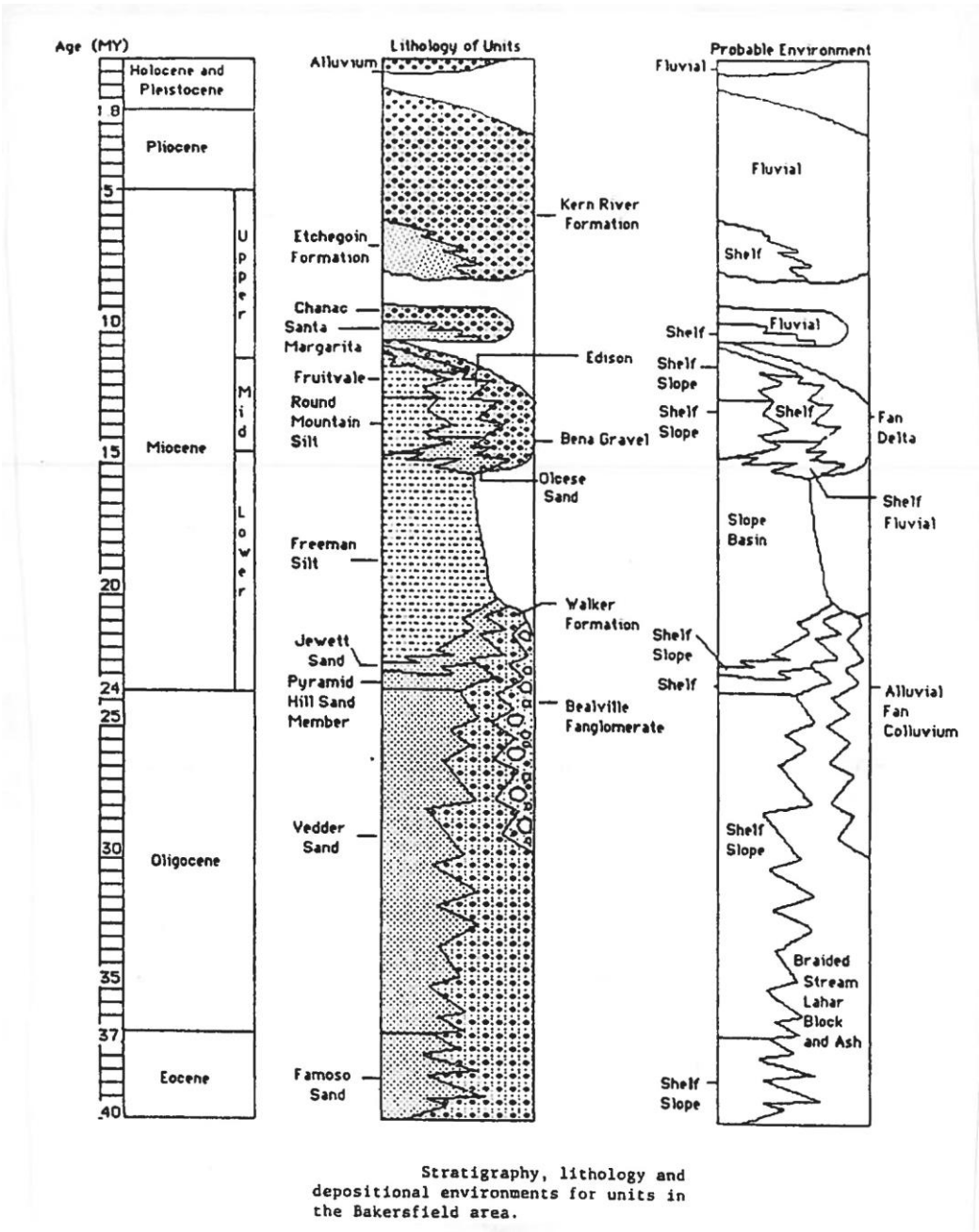
| Era or Erathem | System or Period | Series (Epoch) | Age Estimates (boundary in millions of years ago) | Outstanding Events in Physical History and Living History |
|---|---|---|---|---|
| | Quaternary | Holocene | | Several Glacial Ages, Homo Sapiens |
| | | Pleistocene | | Great Lakes, Missouri and Ohio Rivers |
| | | | 1.8 | |
| | | Pliocene | | Later Hominids |
| | | | 5.0 | |
| | | Miocene | | Colorado River, Primitive Hominids |
| | | | 22.5 | |
| Cenozoic | Tertiary | Oligocene | | Basins and Ranges, Nevada, grasses, grazing mammals |
| | | | 37.5 | |
| | | Eocene | | Volcanic Activity, Yellowstone, primitive horses |
| | | | 53.5 | |
| | | Paleocene | | Rocky Mountains, spreading of mammals |
| | | | 65.0 | Dinosaur extinction |
| | Cretaceous | | | Lower Mississippi River, flowering plants |
| | | | 136.0 | Climax of dinosaurs |
| Mesozoic | Jurassic | | | Birds |
| | | | 190-195.0 | |
| | Triassic | | | Atlantic Ocean, cycads, conifers, primitive mammals |
| | | | 225.0 | |
| | Permian | | | Climax of making of Appalachian Mountains, Mammal-like reptiles |
| | | | 280.0 | |
| | Pennsylvanian | | | Coal forests, insects, amphibians, reptiles |
| | | | 320.0 | |
| | Mississippian | | | |
| | | | 345.0 | |
| Paleozoic | Devonian | | | Earliest economic coal deposits, amphibians |
| | | | 395.0 | |
| | Silurian | | | Land plants and land animals |
| | | | 430-440.0 | |
| | Ordovician | | | Beginning of making of Appalachian Mountains, Primitive fishes |
| | | | 500.0 | |
| | Cambrian | | | Earliest oil and gas fields, marine animals abundant |
| | | | 570.0 | |
| Precambrian | | | | Oldest dated rocks, primitive marine animals, green algae, bacteria, blue-green algae |

Figure 1. Geologic Time Scale




*Evolution of sedimentation in southern San Joaquin Valley. Thicknesses of sediment increased as the Tertiary advanced, with depression of basement and concomitant development of east-west arches and domes. Although the sections are for the southern San Joaquin, they represent conditions throughout the Great Valley. Note that the contact between Franciscan and plutonic basement is not defined, although it is presumed to be an east-dipping fault. (Source: California Division of Mines and Geology)*

Figure 2. Cross Sections through the San Joaquin Valley (Webb and Norris, 1966).




Stratigraphy, lithology and depositional environments for units in the Bakersfield area.

Figure 3. Stratigraphy, lithology and depositional environments

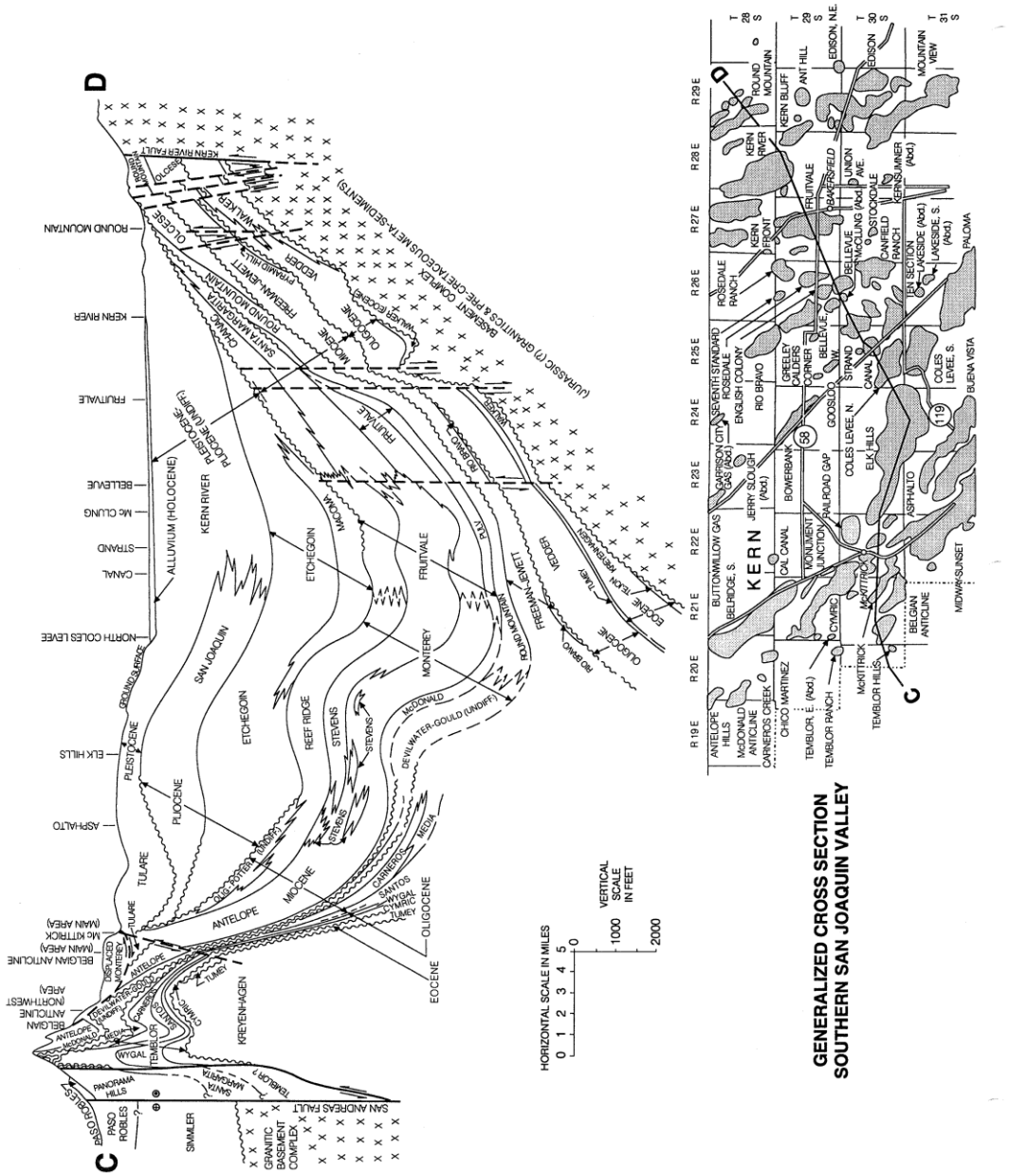



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Figure 4. Generalized Cross Section of Southern San Joaquin Valley (From CDOGGR)

AREA MAP 02

7.2 Kern Bluff oil field on left (north). This oil field is a faulted homocline (Figure 5).

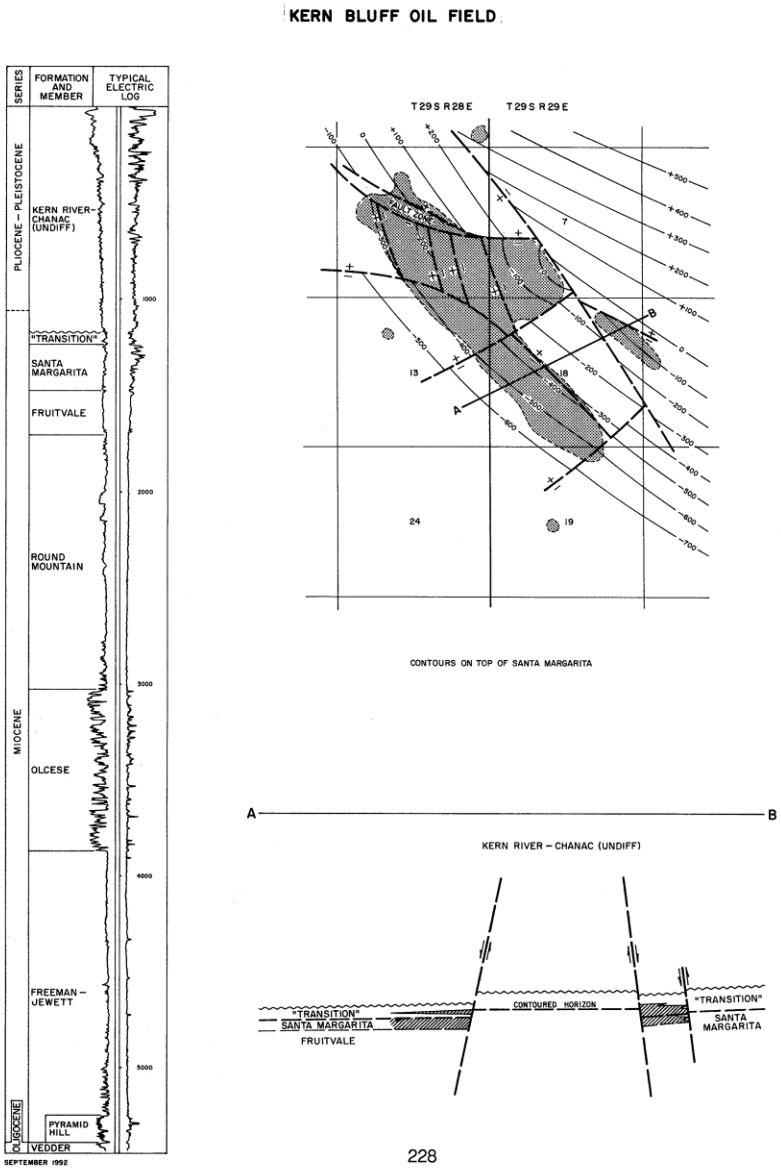



Figure 5. Kern Bluff Oil Field (from CDOOGR).

8.1 Mesa Marin Raceway (Former location, now a sports complex development).

A this point you can see Pyramid Hill to the north with its white pyramid shape. The exposed formations are the Walker, Vedder, Round Mountain and Olcese. These formations have known oil production beneath the valley floor to the east.

9.2 Housing development of Vista Finestra on the left.

9.6 Green Hills Drive. This development originally used water from wells. This water became contaminated with oil from the Ant Hill oilfield. The water wells were abandoned and now these homes get treated water from the Kern River.

Ant Hill oil field on far south (right). The 315 acre field was discovered in July, 1944. The structure is a faulted anticline. The field produces primarily from the Miocene Olcese and Miocene Jewett sands. At the end of 1992, cumulative production has been 7.4 million barrels of oil and 233 billion cubic feet of gas. In 1992, production was 57,364 barrels of oil from 14 producing wells.

Edison oil field on south (right) . The 7935 acre oil field was discovered in July, 1928. The structure is a faulted homocline. Oil production is from the Plio—Pleistocene to Cretaceous formations. At the end of 1992, cumulative production has been 138.2 million barrels of oil and 71.6 billion cubic feet of gas. In 1992, production was 825,695 barrels of oil and 126.2 million cubic feet of gas from 705 producing wells.

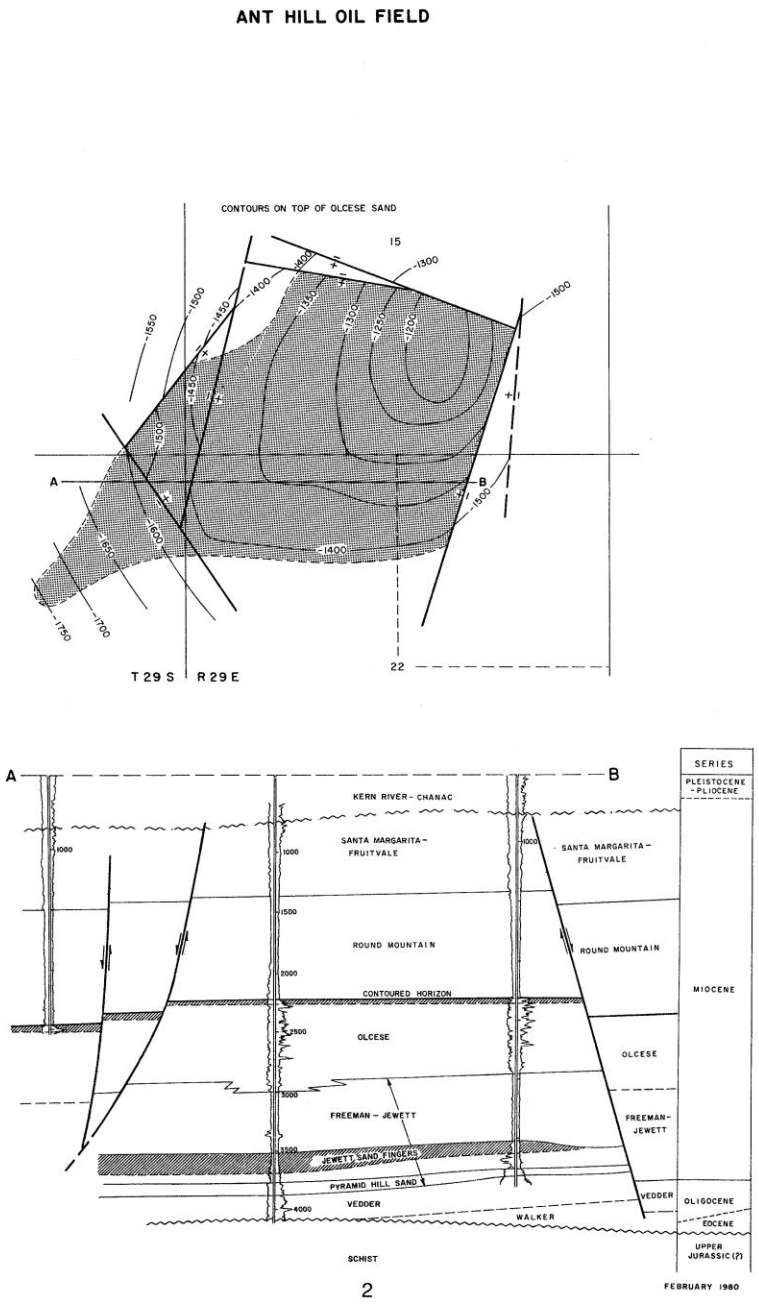



Figure 6. Ant Hill Oil Field (From CDOGGR).

9.8 Comanche Road. Ant Hill oil field on far right (south). This field was discovered in 1944. The structure is a faulted anticline. The field produces primarily from the Olcese and Jewett sands (Figure 8).

10.2 Highway 184 intersection. KEEP STRAIGHT ON HIGHWAY 178. At this point you are traveling through the Chanac and Santa Margarita formations.

10.7 Alfred Harrell Highway intersection. Rio Bravo Resort is on the left (north). At this point you are traveling through the Santa Margarita and Round Mountain silts. Following the road to the north (Alfred Harrell Highway) you can see the light-colored Santa Margarita outcrops.

This area is the natural habitat of the endangered Bakersfield cacti. These individuals of the species (Opuntia treleasei) (Coulter), also known as Bakersfield cactus, are part of a colony which extends along the sandy embankments of Caliente Creek and in the past within Cottonwood Creek. Although some small colonies can be found in the foothills of this area, the geographic distribution of this species is so restricted, and such a small fraction remains of the original population, that endangered species status has been conferred upon this cactus. Intensive farming over the past century has played a major role in the reduction of the size of this colony. South of State Highway 58 a portion of Sand Ridge on Caliente Creek has been purchased by the Nature Conservancy and planting has been initiated to help re-establish this species in other areas.

11.0 Rio Bravo Golf course and the Rio Bravo housing development is on the right.

11.2 This is a terrace of the Kern River gravels. The road cut exposes gold-bearing gravels.

11.4 Hydroelectric canal for new power plant on left at 11:00, (north).

12.7 Former U.S. Forest Service, Greenhorn Ranger District Office.

12.3 Father Garces Monument

12.4 Junction with Rancheria Road. Just north of this junction on Rancheria Road the bridge crosses the modern Kern River gravel deposits. Before the present

day Kern Canyon Highway 178 was developed, this was part of the old road system to the Isabella-Kernville area.

## AREA MAP 03

13.3 Rio Brave Ranch Headquarters and Cafe

13.5 An old rock quarry is located in the hills on the right (south). Crossing the Cottonwood Creek bridge. Gold production occurred upstream from the bridge.

13.6 The road cut on the right is through the Round Mountain Silt outcrop.

13.8 Merle Haggard's old ranch.

## WATER DISTRIBUTION OF KERN RIVER

The Declaration of Independence was still 52 days from completion when the first white man crossed what is now the Kern River in the Bakersfield area. Father Francesco Garces, seeking a practical overland route from the Spanish settlements in New Mexico to Monterey, California, arrived at the Yokuts Indian Village of Woilo, May 7, 1776. Friendly Indians assisted the Franciscan Padre, a non—swimmer, to cross the stream which Garces named Rio de San Felipe. The Indians had called the river 'P0-sun-co-la'. Captain John C. Fremont, seventy years later, renamed the stream in honor of one of trip's surveyors, Lieutenant Edward Meyer Kern.

The Kern River consisting of the North Fork and the South Fork branches is the largest water source in Kern County. The river drains about 2,420 square miles (3872 square kilometers) flowing south from the origin, the 14,496 foot peak of Mount Whitney, into Lake Isabella, an irrigation and flood control lake completed by the Army Corps of Engineers in 1954, and onto the valley floor. The average annual runoff is 760,000 acre—feet of water. (An acre— foot is 325,851 gallons of water.) The gradient (drop in elevation) of the North Fork is 90.3 feet per mile (17.2 meters per 1 kilometer). (One kilometer equals 0.625 miles.)

Before irrigation projects changed the natural drainage, the river, when rounding the bluff, changed course many times. New channels were formed during floods, because

old channels and distributaries had become choked with alluvial debris during low stages. The principal known channels were: Old South Fork, ( present location the canal beside Beale Library) which flowed southward from its head, 2 miles northeast of old Bakersfield, to its outlet in Kern Lake; Old River, (present location Old River Road) which flowed southwestward from its head 1½ miles west of Bakersfield, toward a point between Kern and Buena Vista Lakes; and Buena Vista Canal Slough, which left the present channel of Kern River 2 miles below the head of Old River and flowed southwestward to Buena Vista Lake. In between the branches of the river were numerous marshes, swamps, 12 and lakes. One lake was called Reeder Lake and was located at the site of Jastro Park near Truxtun and Oak.

The main waterway of the Kern River until the flood of 1862 through the valley was the Old South Fork. In 1862, at Keysville (near Isabella Dam), the river was 45 to 50 feet above flood stage. Poso Creek, a tributary of Kern River, was 60 feet above flood stage. The subsequent main channel from 1862 to 1867 was Old River until the modern Kern River channel was formed by the floods of 1867-68. Since that time, the river has been controlled in the modern main channel with many of the old distributaries modified for use as irrigation channels (Wood, et al, 1964)

For an unknown period before 1862, runoff from the Kern River entered Kern Lake and overflowed through the Connecting Slough into Buena Vista Lake basin. During the floods of 1867-68, the river shifted course farther westward and entered Buena Vista Lake directly. For a time the river water flowed eastward through the slough into Kern Lake. Before artificial restriction of valley waters, the total area covered by Kern and Buena Vista Lakes combined was about 80 square miles. The maximum depth of water in either lake did not exceed 14 feet.

Old maps (California State Engineering Department, 1885) indicate that when the, Kern and Buena Vista Lakes were surveyed in February 1878, the lake areas were 14 and 25 square miles, respectively. In January, 1880 the combined area had decreased to 10—13 square miles with a maximum depths of less than 10 feet. The lakes were surrounded on the north and east by tule swamps and were almost unapproachable from the south or the west because of the deep slimy ooze that composed the banks and bottoms. At that time, the winding slough that connected the lakes was 12 or 13 miles (19.3 to 19.9 meters) long, 100 to 150 feet (30.5 to 45.2 meters) wide, and 3 to 5 feet (1.0 to 1.6 meters) deep.

In 1891, a high levee was constructed along the east line of T. 32 S., 25 E., to convert Buena Vista Lake into a large storage reservoir. A short time later, the Kern Lake bed after drying was placed under cultivation.

The modern Kern River has a channel into old Buena Vista Lake. Now used by farming, the old lake bed is rarely used today except in years of heavy rainfall. In very wet years, the water drains into Buena Vista Lake, overflows north along the west side of the Valley to Tulare Lake, into another channel leading to the San Joaquin River system, through the delta, and exiting to the ocean through San Francisco Bay. In 1983, a very wet year, several persons using the reestablished waterways on the west side, went by boat from the 24th Street Bridge to San Francisco Bay in six days.

## 14.2 PG&E POWERHOUSE

### STOP NO. 1. MOUTH OF KERN CANYON: PG&E POWER HOUSE

Figure 7. PG&E Power Plant.

From http://bloximages.newyork1.vip.townnews.com/bakersfield.com/content/tncms/assets/v3/editorial/0/0f/00fc2b23-991b-55da-b2c9-914cc5076094/5913afda842cf.image.jpg?resize=1200%2C531 accessed Oct. 26, 2017.

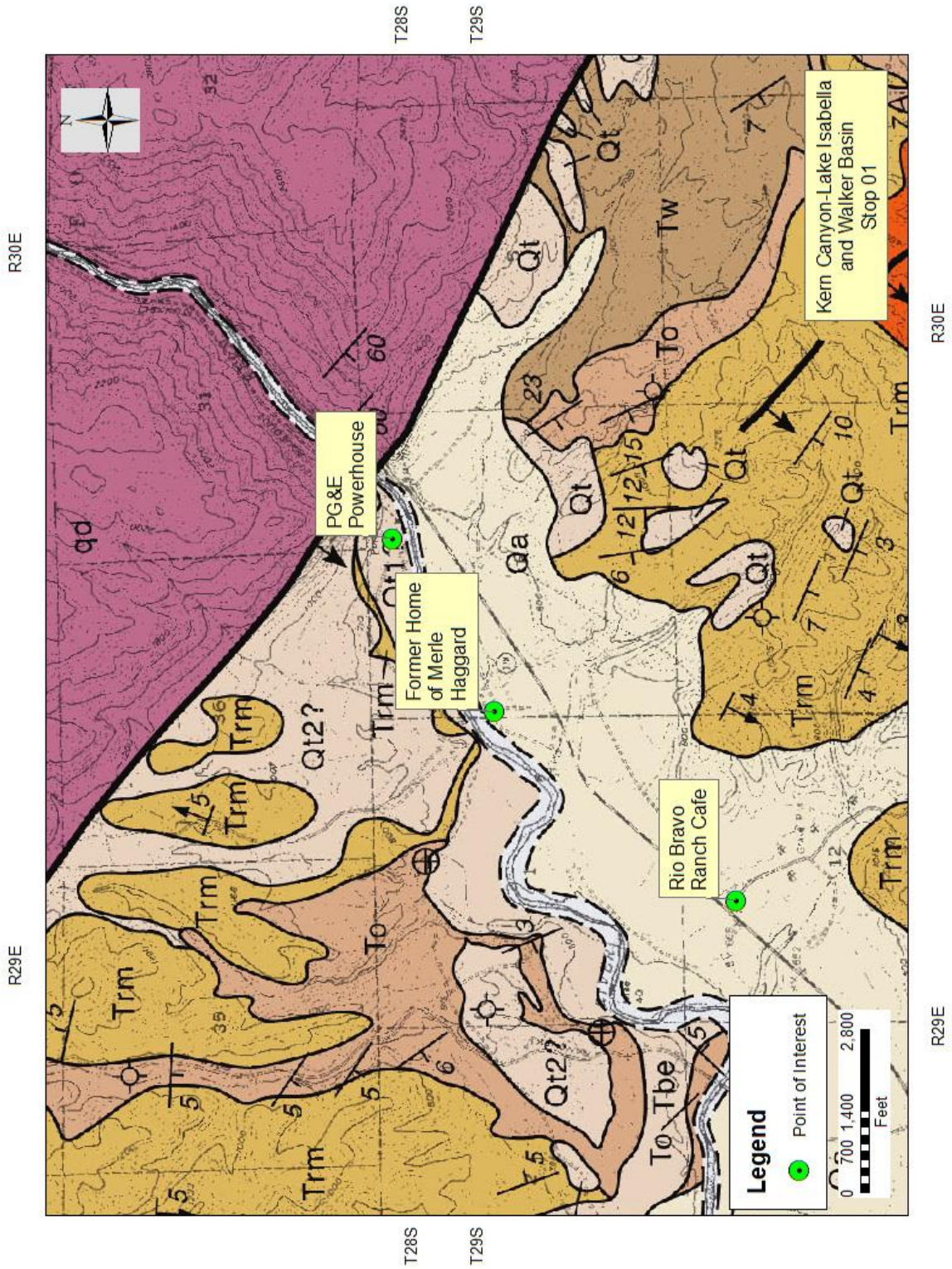



Figure 8. Geologic Map of Stop 1. Geology adapted from Dibblee, 2008a.

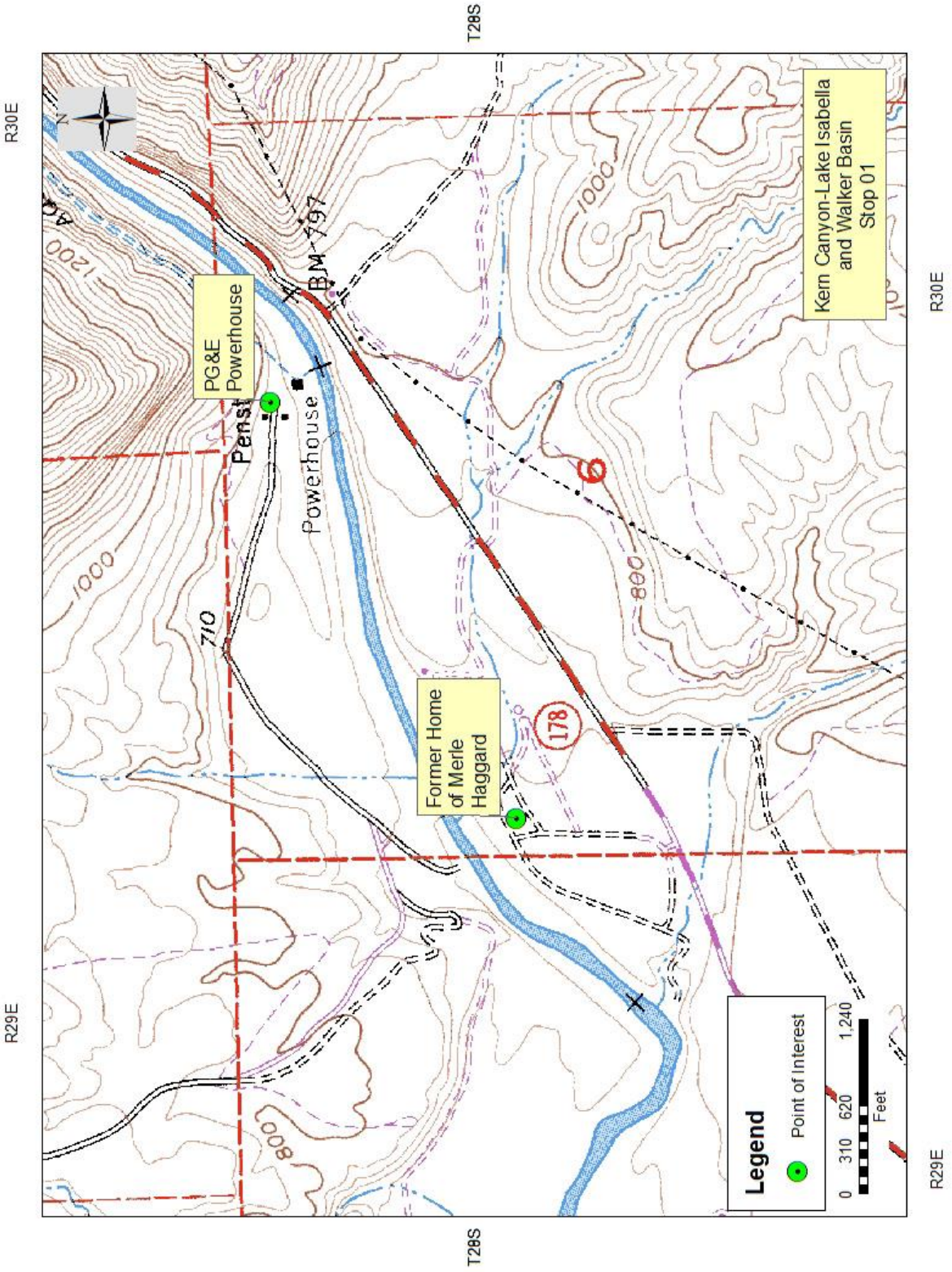



Figure 9. Topographic map for Stop 1.

We can observe the contact of the Sierran Batholith and the sediments of the San

Joaquin valley. The "Basement Rock" is called the Isabella Plutons and the sediments at the contact are of the Walker Formation. The fault scarp you see is the Kern Gorge Fault.

The foothills of the Sierra Nevada Mountains in this area have a linear trend that parallels the base of the mountain; and is the surface expression of a major dip-slip fault (i.e. motion was up-down, not sideways). The fault surface is visible in the bare rocks on left (north) side of the river. Slickensides (smooth elongated ridges and grooves) on this fault surface, indicate the direction of movement in the fault. The rocks are part of the "Isabella Plutonic Complex", a group of several smaller "plutons" (Pluto = Greek god of the under-world). Plutons are bodies of magma that formed and cooled slowly deep in the earth's crust. Intrusives of the Isabella Plutonic Complex cooled over a 25 million period. Magmas invaded pre-existing marine, sedimentary, and volcanic rocks and took .5 to 2 million years for each individual intrusive to cool. The remnants of these rocks have undergone metamorphism (chemical and structural alteration) and uplift and are now grouped together as the "Kernville Series". Within this series are distinct marble (metamorphosed limestone), and schist layers. We will see these later in the trip. At this stop the exposed pluton has been named the Bear Valley Tonalite.

We used to think that this fault shows the standard fault-block model for the Sierra - Nevada, namely that there are faults on both east and west sides and the range has been rising for the past 6 million years. Salabe and others now suggest the Southern Sierras have always been high, and that the feature before us is a relic of exhumation, not faulting.

The big boulder rocks in the Kern River at the Power Plant are not from the Kern Canyon. These were deposited in the area that is now the mouth of Kern Canyon by a river and associated mud flows that flowed north out of Caliente Creek.

Pacific Gas and Electric has a hydroelectric power plant here. The plant was originally built in 1912 and reconstructed in 1923. The water enters the 2-mile aqueduct tunnel system located on the north side of the river on the canyon wall 1 miles into the canyon just south of the site of the Kern River # 1 plant operated by Southern California Edison Electric. The water exits the aqueduct tunnel system at the mouth of the canyon. The plant is semi-automatic and has a capacity of 108 KW.

This plant originally had Direct Current (DC) generators. Lines from this plant went through Arivin, and over the Grapevine into the San Fernando Valley and Pasadena. The electricity powered Pasadena's "Little Red Car" trolley system. My grandad Joseph Johnston worked on the trolley line as a conductor.

Figure 10. Joseph Winter Johnson and Little Red Car Crew circa 1925 (Wilkerson family archive).

The plant was built before there was a road up the Kern Canyon. Transportation for services was by mule train. Several old mule trails can still be seen on either side of the canyon. Access and ventilation cross cuts were made along the tunnel to provide places to remove the debris extracted from the tunnel.

## GOLD IN KERN COUNTY

In terms of total dollar value and number of deposits, gold is the most important metallic mineral commodity that has been produced in Kern County. From 1851, when it was discovered in Greenhorn Gulch near the Kern River, through 1957, the value of gold mined in Kern County exceeded $46,000,000.

The first lode mining was in 1852 at the Keyes and Mammoth mines in Keyesville, and by 1865 gold was being produced from at least four districts in the Kern River country: the Keyesville, Clear Creek (Havilah), Greenhorn Mountain, and Cove (Kernville) district. Gold was so important to the economy of Kern County during this period

that Havilah, a remote settlement 7 miles south of Lake Isabella, was the county seat from 1867 to 1874. The gold and silver produced from these districts has been estimated at several million dollars, although no production records are available for the period before 1880. In 1894, gold was discovered on Standard Hill in Mojave district, through 1958, gold and silver valued at about $20,000,000 was produced from the four isolated buttes that comprise the district. Discovery of gold at the site of Yellow Aster mine in 1895 led to development of the Rand district and an eventual total yield of at least $20,000,000 (1962 value) in gold and silver.

Although most of the gold deposits in the county are in the Sierra Nevada, these deposits have a lower average yield than those in the Mojave Desert region and they are more widely spaced. The nine principal districts in the Sierra Nevada have a combined minimum output of about $7,000,000 (1962 value) in gold. These districts in the approximate order of decreasing productivity according to recorded production are: the Cove (Kernville), Keyesville, Clear Creek (Havilah), Loraine, Pioneer, Piute Mountains (Green Mountain), Poso Creek, Woody, and Greenhorn Mountain districts. Nearly all of the gold deposits of the Sierran mines are in quartz veins in granitic rocks, related alaskite and aplite, and rhyolitic dikes. Other metallic minerals, with the exception of iron sulfides and silver minerals, are generally absent. Scheelite is present in a few veins, and galena, sphalerite, chalcopyrite as common in the Cove (Kernville) district.

We are now entering the Kern River Mining District.

Kern River Canyon Mining District discussed herein is a 20-mile strip from 1 to 2 miles wide, extending from Bodfish southwestward along the Kern River to the west front of the Sierra Nevada, about 10 miles northeast of Bakersfield. Presently, gold can be recovered in small quanitities from fluvial gravels throughout the Kern River even as far west as Hart Park.

Placer gold and uranium deposits, mostly in the northeastern half of the area, have been mined, and lode gold as well as lode and placer tungsten deposits have been explored. Placer gold deposits were mined as early as 1851 in Greenhorn Creek (Gulch) near its confluence with the Kern River. Although little is known of the area's early placer mining activities, the deposits apparently were few and soon worked out.

The most productive placer gold mine apparently was the Greenhorn Caves mine in Greenhorn Creek with a reported total production valued at $60,000 (1958 values). No reliable estimates of total production from placer mines in the area is available. Of the numerous prospects for lode gold and tungsten, only the GEM Mine was of any consequence. At the GEM mine, 1 mile southwest of Democrat Hot Springs, reported total production was valued at $30,000 (1958 value).

The most recent mining interest in the Kern River Canyon area is in the uranium deposits, discovered by Harry B. Mann in January, 1954. Through 1958, the Kergon, Little Sparkler, and Miracle mines, yielded a total of about 11 railroad cars of ore which averaged about 0.3% uranium ore.

The gold and tungsten placer deposits are in the recent gravels of the Kern River and its tributaries. The gold is probably derived from the Greenhorn Mountain, Keyesville, Clear Creek, and the Cove (Kernville) districts, which lie within a ten-mile radius to the north and northeast. Most of the scheelite (tungsten) probably is derived from the Clear Creek district.

Uranium mineralization apparently is confined to a 1-square mile area centered about 1 miles west of Miracle Hot Springs. The uranium is found along fractures and shears which have no apparent favored orientation. Ore deposition was controlled by intersection of shears and fractures or by abrupt changes in the dip of the vein.

14.2/0.0 AFTER STOP NO. 1 AT PG&E POWER HOUSE, RESET ODOMETER AT ZERO.

0.1 Look to the right. We will pass a tunnel that is excavated along a non-gold bearing quartz vein at a 90 degree angle to the roadway. Throughout the Sierras many gold deposits occur in quartz veins and tunnels of this type are common.

0.5 Aqueduct muck tailings on left (north) are from the P. G. & E. construction.

The aqueduct and it's tunnels were made by miners who gave up trying to make money at the mines and worked for wages by Southern California Edison.

As with all mining, this was dangerous work. During construction of one of these tunnels, there was a cave in, and one miner survived by diving under and ore car. He was trapped and only had a small opening to the surface. Pipes where snaked down to him and he was supplied with water and milk for 3 weeks while crews worked to free him. His rescue became national news and when he came out he was greeted by the governor and the president of Southern California Edison. He became a speaker and went around the country telling of his ordeal. The stress of his survival was too great and he committed suicide.

Note the several fracture patterns in sets in the granitic rocks. The fractures formed in response to the compressive tectonic forces that are lifting the Sierras above the valley floor.

Note the remnants of ancient landslides and old valley floors that now cling to the sides of the canyon. In a large magnitude earthquake, several of these old landslides might reactivate and block the Kern River Canyon, creating a long lake behind the landslide. Because the slide deposits have only been moved a short distance from their source, they do not contain gold. Placer gold deposits are concentrated by movement of water in sediments and are found by boulders in the active stream beds and in ancient river gravels, similar to those seen earlier. Gold is also mined from quartz veins and these are called lode deposits.

1.3 Contact between dark, xenolith-rich Bear Valley Tonalite and the whiter, xenolith-poor Mount Adelaide Granodiorite. Observe the landslide to the north (left). Note change in course of river along the contact.

1.5 Southern California Edison Hydroelectric Plant, Kern River #1. This plant was built in 1902 and has a capacity of 300 KW. The plant rests on Mount Adelaide Granodiorite.

Figure 11. Southern California Edison Kern River NO. 1, 1908.

From http://hdl.huntington.org/cdm/ref/collection/p16003coll2/id/12424 accessed oct. 26, 2017.

This plant's water source for power generation consists of a 19 tunnel-1705 feet open flume aqueduct system collected 12.5 winding miles upriver at the Democrat Dam (originally built for hydroelectric purposes) located southeast of the resort, Democrat Hot Springs. The shorter, straighter, 8 mile long tunnel/flume system is on the south rim of the canyon.

The aqueduct is the water source of the streams entering the Kern River from the south side.

1.9 River Terraces. The flat-topped inclined landforms you see as you drive up the canyon are old valley floors. Continuous uplift or down-cutting has allowed the river to cut down through the.

2.4 Observe the spring activity and green growth on your right (south). This is caused from the leakage of the aqueduct.

Figure 12. Aqueduct leakage August 18, 2004. Photo by Gregg Wilkerson

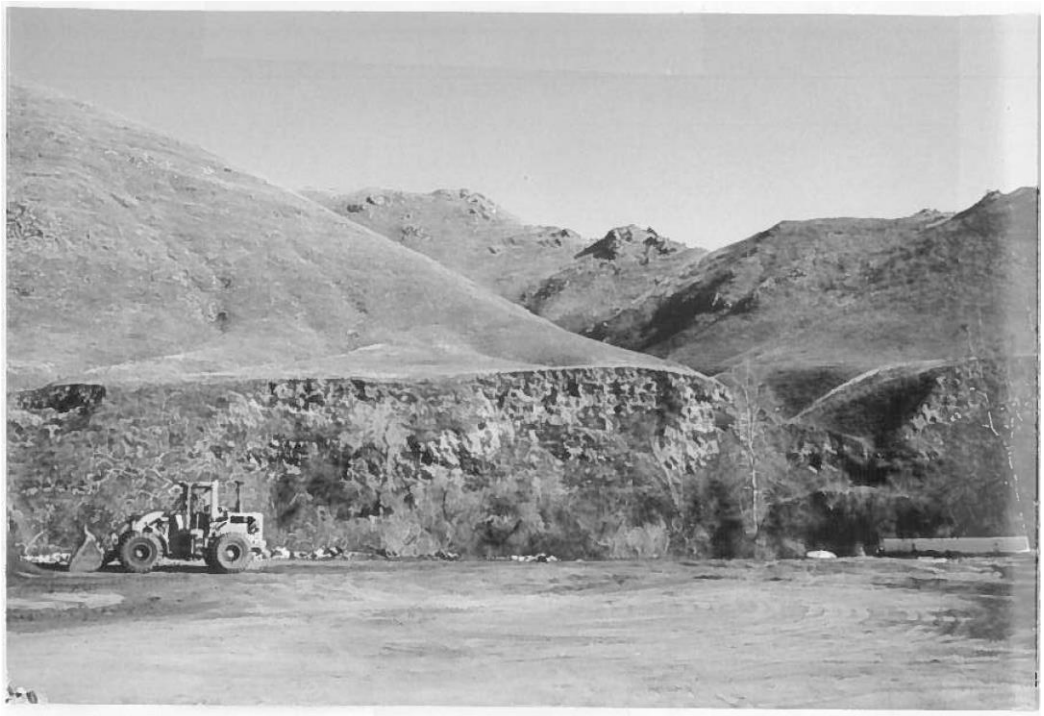
3.4 Boulder Island on left (north). There is some gold in the layered portions of this island.

## AREA MAP 04

4.5 "Nude Beach" on left (north). This sand deposit is rich in magnetite, also known as a "black sand".

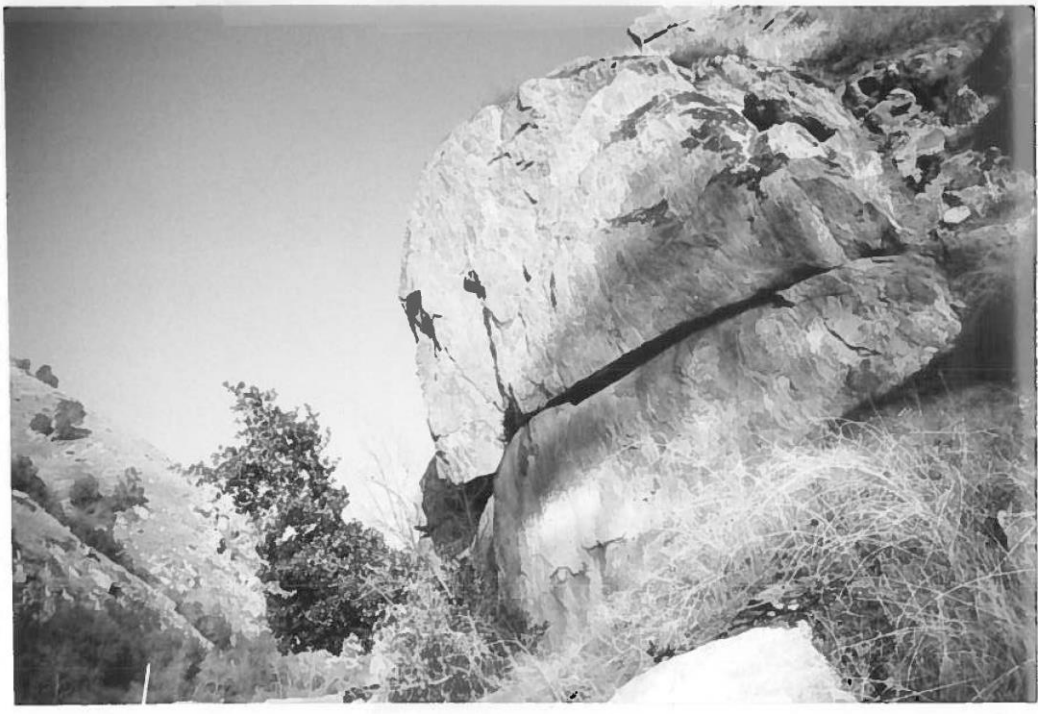
4.6 Contact between Mount Adelaide Granodiorite and the Bear Valley Tonalite.

4.7 River terraces are on the left (north). Some of the old river deposits have been worked by hydraulic mining. Note mule trails on either side of canyon.



Area of Hydraulic Mining on the Kern River

River Terrace



Weathered granite boulder of Bear Valley Tonalite with xenoliths

Figure 13. Richbar Hydraulic Terrace (above) and Bear Valley Tonalite (bottom). Photos by Gregg Wilkerson, 1993.

4.8 Contact between Bear Valley Tonolite and Ultramafic mass.

5.2 Live Oak Campground.

5.4 Hydraulic workings on left (see title page of this road log).

5.5 Waterfall on right (south) is from aqueduct overflow above the roadway. Observe the river terraces on the left (north).

The old Frenchtown trail is on the right and heads up to the old settlement of Frenchtown. (THIS IS PRIVATE PROPERTY AND SHOULD NOT BE ENTERED WITHOUT THE OWNER'S PERMISSION.)

5.6 Gabbro and gabbro-diorite (calcic plagioclase and clinopyroxene) with white quartz veins on either side of canyon.

5.8 Lower Richbar. The mine above and to the right (south) of Richbar may have been an unnamed tungsten mine. This area was first mined by Dutchmen, and the original name was Dutchbar. The formation at this point is the Mount Adelaide Granodiorite.

6.0 The road at the 20.00 mile marker goes to the aqueduct. The water in the stream on the right is spillage water from the aqueduct.

6.1 Upper Richbar. In the old river gravels around Richbar, and elsewhere on the Kern, a common prospecting method was to pan the cuttings brought out by squirrels from their dens.

6.3 "DANGER DON'T SWIM" sign is on the right (south) side of the road.

Area of hydraulic mining on the left (north). Several old sites of hydraulic mining exist along the Kern River. This mining method was very efficient, and enabled the miners to work material that was .25 oz. of gold per ton of rock. The practice was discontinued because of a class action lawsuit in 1884. Siltation problems were ruining the fisheries and silting up the rivers under the Sawyer Decision required mining companies to keep their tailings from polluting fisheries and farms downstream of the mining operations. For a

while coffer dams were built to retain the tailings, but these inevitably failed during El Nino Storms. Then vast quantities of tailings were released, causing extensive environmental and agricultural damage.

## STOP NO. 2: RICHBAR HYDRAULIC MINING

Here we see relics of stream diversion during the hydraulic mining era. The Kern River was diverted to the southeast so the river terrace to the northwest could be washed away to get at underlying gold-bearing gravels.

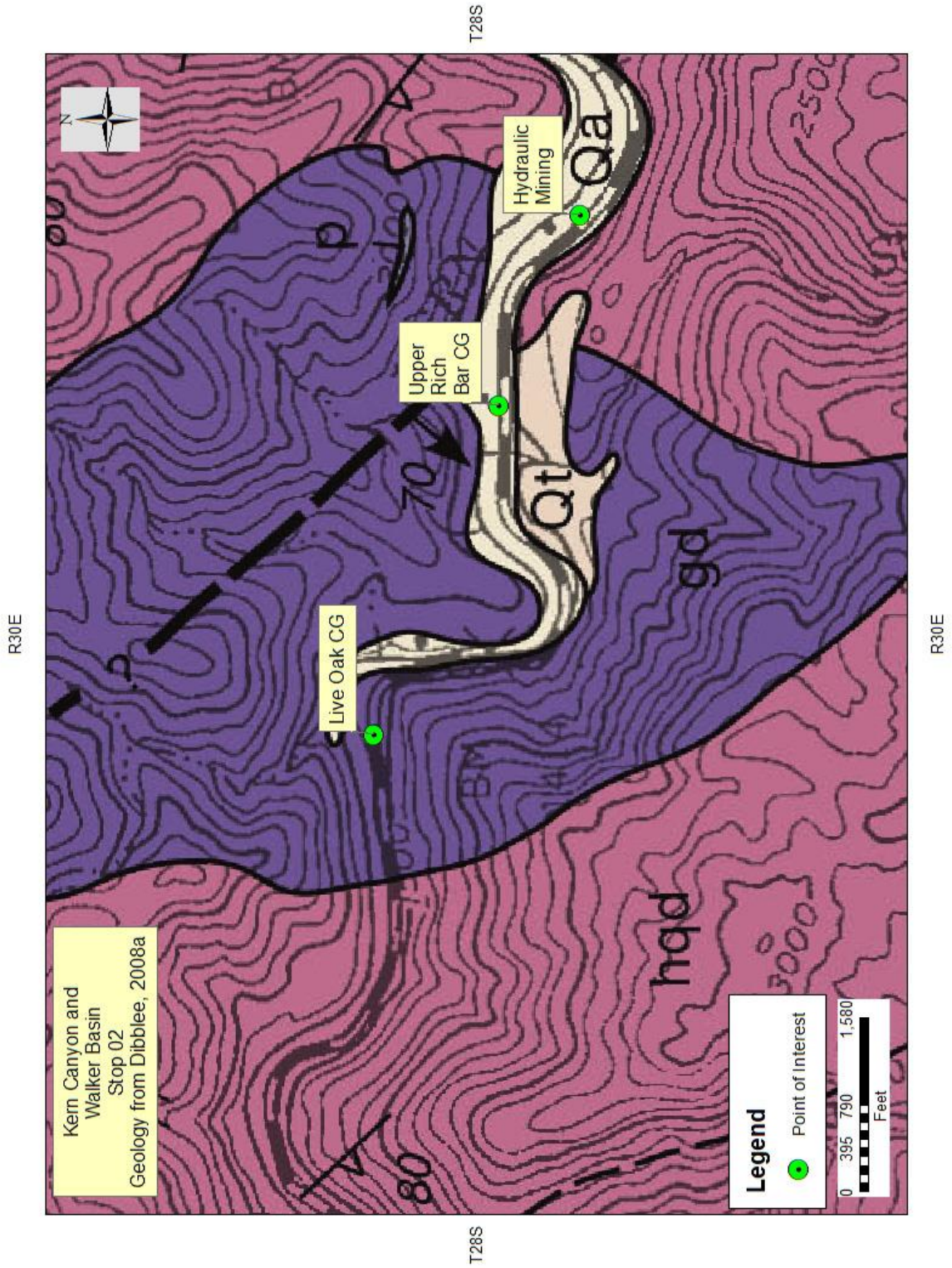



Figure 14. Geologic Map of Stop 2. Geology adapted from Ross, 1995.

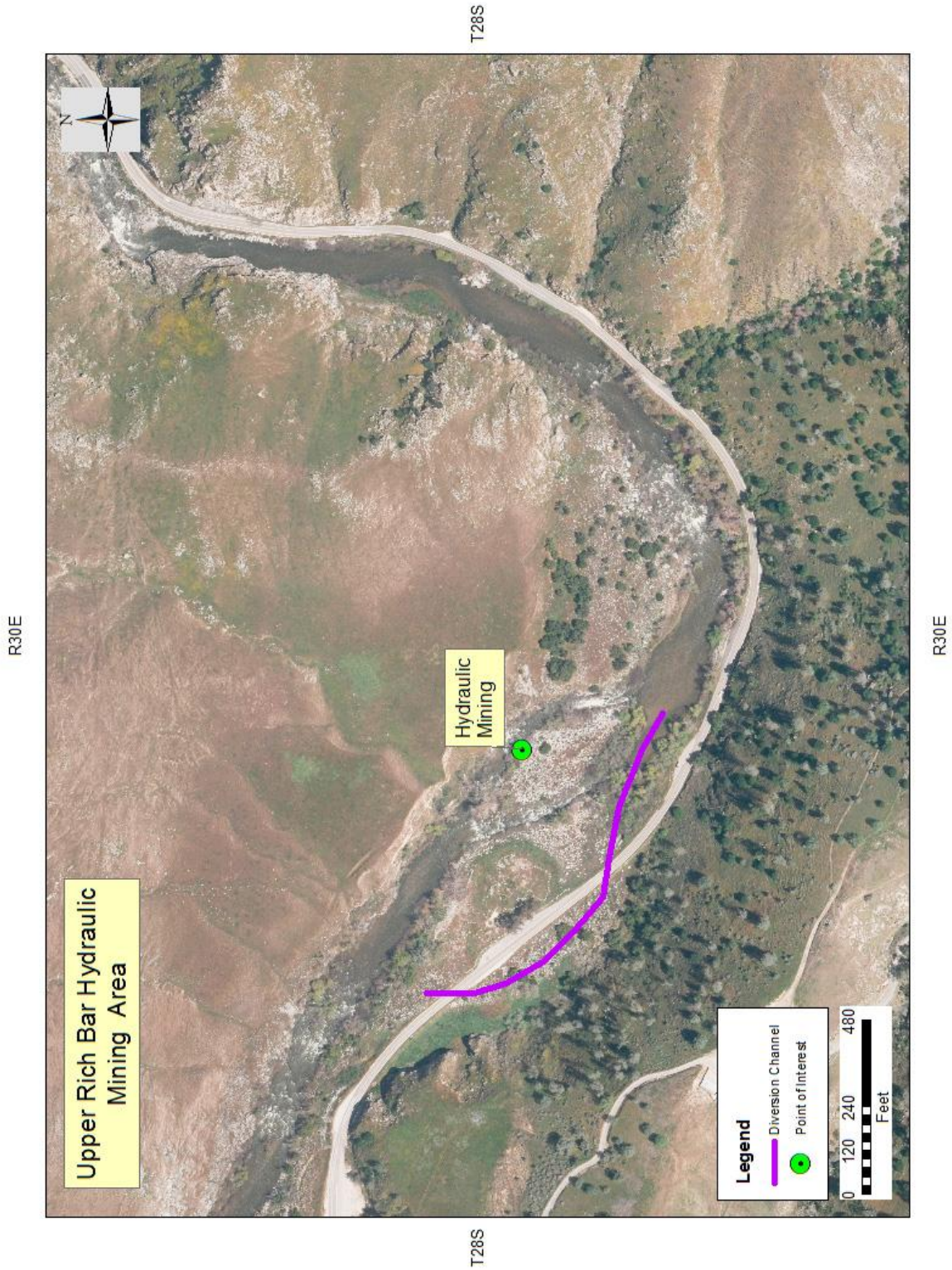



Figure 15. Aerial photograph of Stop 2 at Upper Richbar showing stream diversion.

6.5 Old mule trail is above on the right (south).

6.6 What appears to be a spring in this side canyon is actually leakage from the underground aqueduct on our right (south). The formation is the Alta Sierra Granodiorite.

Throughout this segment of the trip there are several white and blue/green road marker signs labeled "SAL". These identify nesting sites of an endangered Kern Canyon Slender Salamander (Batrachoseps simatus) found within the canyon from an elevation of 1000 feet to 4000 feet (305 to 1220 meters) . The salamander is speckled grayish—brownish—olive in color and the largest species measured was 5.1 inches (120 millimeters) with the tail.

The nocturnal salamander is active during moist periods from November to May and retreats to the underground during dry periods. The salamander seeks cover under surface objects such as logs, boards, moist leaf litter, and rock talus. During drier periods, the species retreats to moist underground niches or seepage areas.

The predators of the salamanders are small snakes, beetle larvae, predatory arthropods, diurnal birds, and small mammals. Most individuals form a tight defensive coil when uncovered or handled.

These species are being monitored, holding up further Highway 178 development.

9.1 The formation is the Bear Valley Tonalite. Notice that the Bear Valley Tonalite has several dark inclusions in it. These inclusions are called xenoliths (xeno = "foreign or strange", lith = "rock"). Several hypotheses exist for their origins. All agree that xenoliths are remnants of pre-existing rock. These remnants may have been caught up in the magma as it invaded the country rock. Alternately, the Bear Valley Tonalite (and other xenolith-rich plutons) may have formed by metamorphic replacement action from a preexisting intermediate-composition plutonic rock (diorite or gabbro). The xenoliths, according to this model, are unreplaced remnants of the original plutonic rock.

## AREA MAP 05

10.0 Outcrop with 85% xenoliths on the right (south). The xenoliths have a variety

of shapes: round, filament, and elongated.

10.7 To the north (right) is the intake for the Democrat Dam power plant built in 1902.

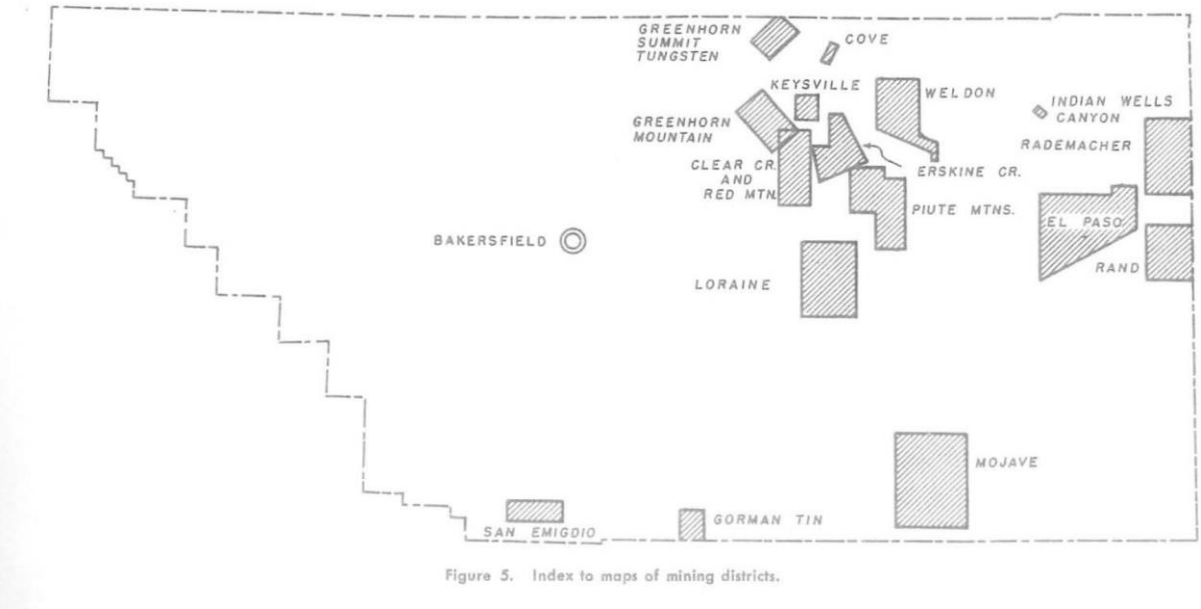



Figure 16. Mining Districts of Kern County (from Troxel and Morton, 1968, p. 25)

11.4 GEM Mine to the right (south). IT IS CLAIMED. DO NOT DISTURB.

GEM Mine. This gold mine is located on a one to four foot wide vein striking northeast. Development consists of a crosscut adit driven 650 feet to the vein, with 60 foot drift southwest and 200 feet northeast. At 550 feet from the adit a 90 foot raise was driven at 45□. From this point a sublevel was driven 110 feet northeast. An ore shoot was encountered in the sublevel, 75 feet from the raise. Ore averaged from $8 to $20 per ton (price before 1962) for 45 feet. Another crosscut adit 200 feet above the first was driven 100 feet to the vein where additional ore was mined.

12.0 Democrat River Raft Trip entrance is to the left (north).

12.1 The Democrat Hot Springs and public campground is to the left, downhill along

the river.

## STOP NO. 3 DEMOCRAT HOT SPRINGS

These springs were opened in 1904. There is currently a private resort there.

Figure 17. Democrat Hot Springs. Historic photo from http://socalregion.com/wp-content/uploads/2013/02/Democrat-Springs.jpg accessed oct. 20, 2017.

Democrat Hot Springs is the westernmost thermal manifestation occurring along the Kern River Canyon. The hot water, with an average temperature of 39°C (102.2°F), drips and seeps through small (less than a quarter of an inch (30 to 60 centimeter)) fissures in a cave—like opening excavated into the soil, at a rate of 15 gallons per minute (56.8 liters per minute) with a Ph of 8.05. The fluids then flow through a plastic pipe into a swimming pool. The water analysis indicates the water has high concentrates of sodium, chloride, silicon, and uranium. The cave like opening has a width of 4 feet (1.2 meters) at the entrance and narrows to less than a quarter of an inch (45 centimeters) in the rear, with a length of 45 feet (13.7 meters) and a height of 5 feet (1.52 meters) at the entrance and 3 feet (0.9 meters) in the back. In 1906, the reported temperature of the water was 46.1°C (115°F) with a flow of 20 gallons per minute (75.7 liters per minute) with other warm springs noted in the area. After the 1906 San Francisco Earthquake the main spring

ceased to flow. The water flow was restored at a new site in the area and by 1908 as a hotel stood at the site and utilizing the thermal springs for balneological purposes. The springs were used by miners, Indians, and explorers in previous years.

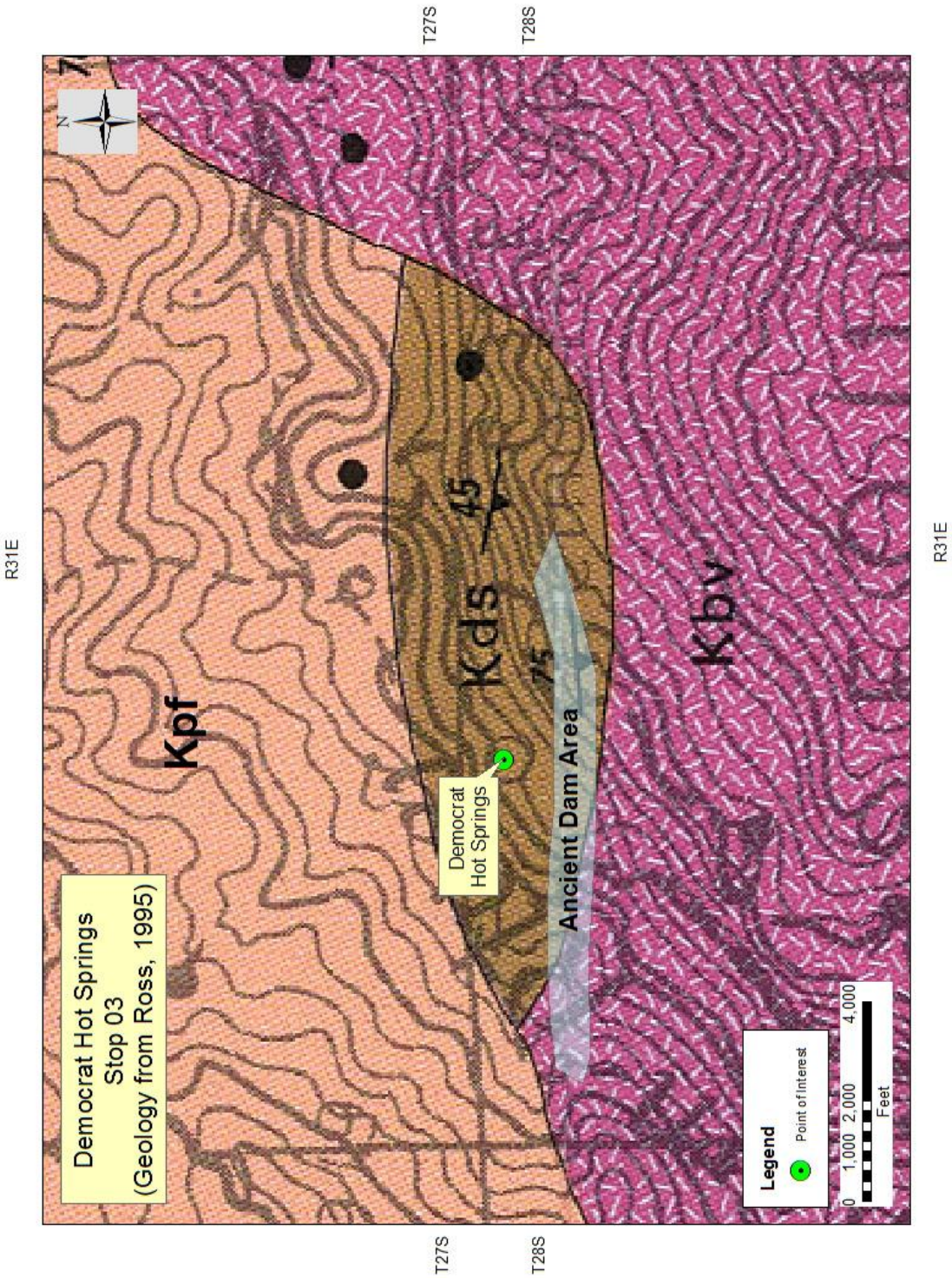



Figure 18. Geology of Stop No. 3. Adapted from Ross, 1995.

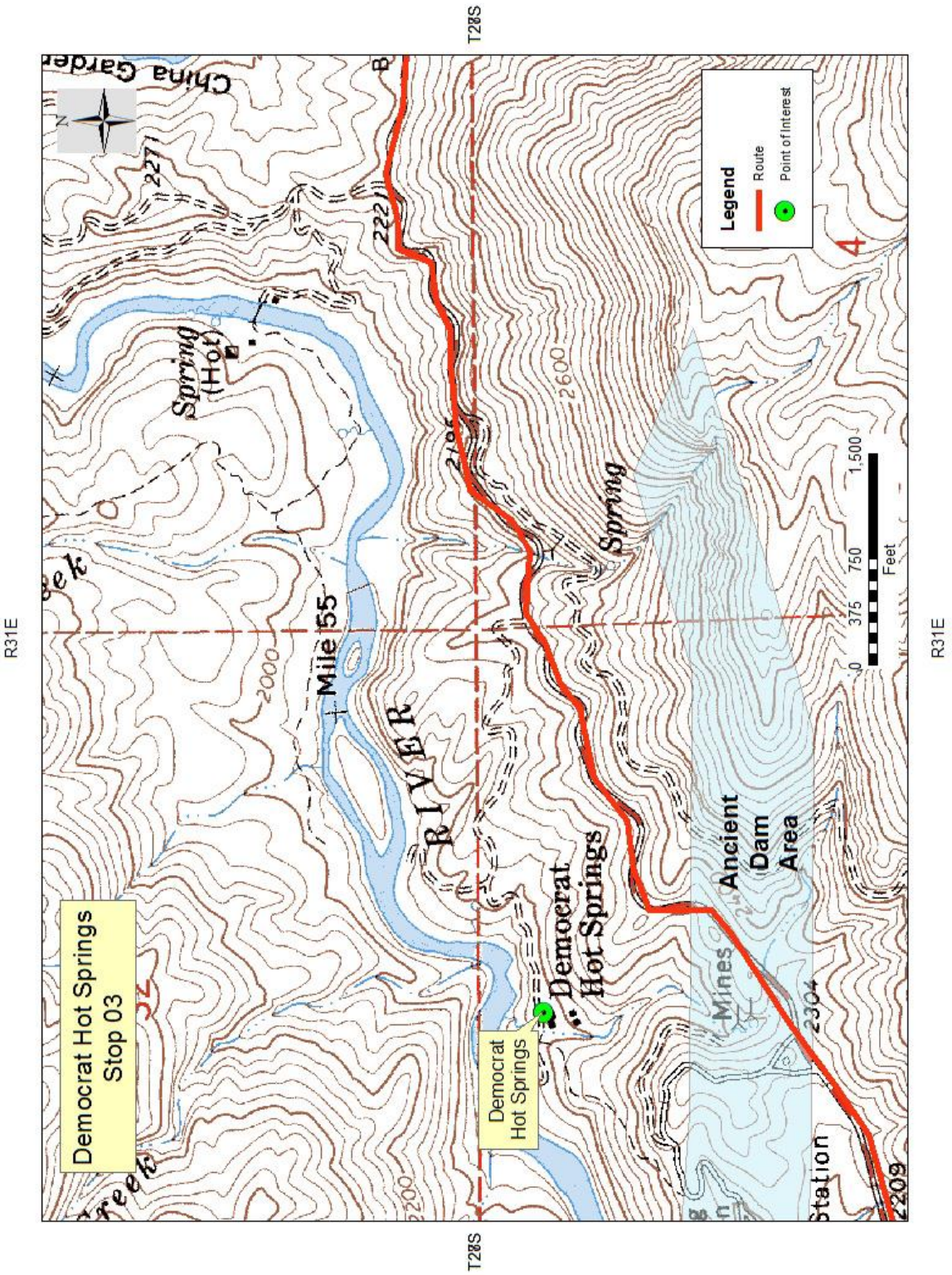



Figure 19. Stop #3 topographic map.

12.2 Caved tunnel on right (south). A large boulder has been moved over the mouth of the tunnel. Above the tunnel up the hill is an upper shaft. From this shaft samples from the quartz vein were assayed at $11.00 per ton (1970 values). That would equate to $1,150 per ton today. Is there, today, a profitable gold mine under that boulder?

12.6 Dirt road to Prefedio Springs can be seen on the left (north) side of the canyon.

12.8 China Gardens turnoff to the left (north). The road goes to a Forest Service picnic ground and an active placer gold mining claim.

China Gardens Hot Springs is located on the west side of the China Garden horseshoe bend of the Kern River. The springs are also called Unnamed Hot Springs. The three linear scattered springs are a tepid/warm water spring system which seep through hairline fissures in a fracture zone in massive rock. The springs having a slight odor of sulfur occur in the lower portions of a horizontal, marshy, tepid ground area on a slope approximately 98.4 feet (30 meters) from Kern River.

The water temperature ranges are from 68°F (20°C) to 82.4°F (28°C) with flow rates of 0.8 gallons per minute (3 liters per minute) . Because of the low temperature and flow rate possibly the only use of the springs has been for mining operations.

13.3 Greenhorn Mountain Range is across the river on the left (north).

13.6 Old Kern River road to Miracle Hot Spring. Miracle Hot Springs was closed due to health and safety violations by the Kern County Health Department. The hot spring waters are high in uranium and radon. Uranium is very common in granitic rocks. In the 1950's some people thought that small amounts of exposure to radioactivity was good for health.

RESET ODOMETER AT HIGHWAY 176 AND OLD KERN CANYON ROAD

## DELONEGA HOT SPRINGS

Delonegha Hot Springs is a few miles ahead of us near where Highway 178 crosses the Kern River. At one time a popular resort, it has been demolished, with only the

foundations remaining. Some crude cement-and-stone tubs were constructed in the ruins and are popular for bathing. HOWEVER, IT IS PRIVATE LAND, AND PERMISSION FROM THE LANDOWNER MUST BE OBTAINED IN ORDER TO USE THE SPRINGS.

This location was named the Delonegha Mining District around 1866 when gold was being carried along the Kern River. The name Delonegha is reported to have come from Dahlonega, Georgia, one of America's earlier gold producing areas; the name originates from the Cherokee word "taulonica," weaning "yellow metal". Throughout history warm water from the springs have served local property dwellers for balneological purposes.

The hot springs was established in 1891 by Simeon Smith at a spot where Indians enjoyed the curative and medicinal powers of the waters. Despite the difficulties of getting to the springs location within a box canyon, the spa became a very popular attraction. A health resort and hotel were built in 1898 and flourished. After several years, business declined and the site was abandoned in 1912. Remnants of building foundations are still encountered in the area. The two cement and stone basins collecting the water were constructed by occasional visitors to the site who remain as unwanted trespassers to the site owners.

The warm water seeps out from the lower part of a massive granitic outcrop and accumulates in cement pools before overflowing into the Kern River. The two hot springs flow at a rate of 2.6 to 3.9 gallons per minute (10 to 15 liters per minute) and have a temperature of 113.9°F (45.5°C). No hydrothermal alteration was observed in the area and only a faint sulfuric odor was detected. The Delonegha Hot Springs waters as well as Miracle Hot Springs contain uranium and radon.

At that time Delonega Hot Spring resort was originally developed the mule trail from the mouth of Kern Canyon passed this way on the way to the village of Hot Springs (now Lake Isabella). Then the 2-lane road was built in the canyon in 1933, this area was by-passed in favor of a route that went by Miracle Hot Springs. After this, Delonega went bankrupt and Miracle flourished. Then in 1976 the present 4-lane highway was opened up. Traffic again went to the north side of the river and Miracle hot springs resort decayed and eventually was closed by the U.S. Forest Service and the Kern County Department of Public Health.

Here is a recent description of Delonega Hot Springs:

*Delonegha used to be the little jewel of the Kern River. Unfortunately, a private party purchased it. They were intending to develop it. At the time, the rumor was that they charge five dollars to use the springs. The problem is that in order to keep people out they had the road posted for no parking. They have also bulldozed dirt onto other areas that could be used for parking. A lot of cars park about a mile south of the springs. It appears that everybody then hikes up to the springs. They are well worth the trouble. The springs are of low sulfur water that is a perfect temperature. The view from them is breath taking. There are several pools situated on a ledge overlooking the Kern River. I think they are high enough not to be washed out during the spring runoff. Another set of pools is on the other side of a rock formation that sits next to the river's edge*
(From
http://www.communitywalk.com/location/delonegha_hot_springs/info/14011
accessed Oct. 30, 1017).

## GREENHORN MOUNTAIN MINING DISTRICT

The Greenhorn Mountain District comprises about 20 square miles in area (. The district is approximately 28 miles northeast of Bakersfield and 4 miles northwest of Miracle Hot Springs. Approximate boundaries are the Kern River on the south, Fremont Creek on the west, Woodward Peak on the north, and Black Gulch on the east.

The first gold discovery in Kern County was made in Greenhorn Creek in 1851, by a member of General John C. Fremont's exploration party. An influx of prospectors followed, the town of Petersburg was established near Fremont Creek, and the district was extensively developed. After a disappointing recovery of placer gold, however, interest declined, and by 1900 Petersburg had become a ghost town.

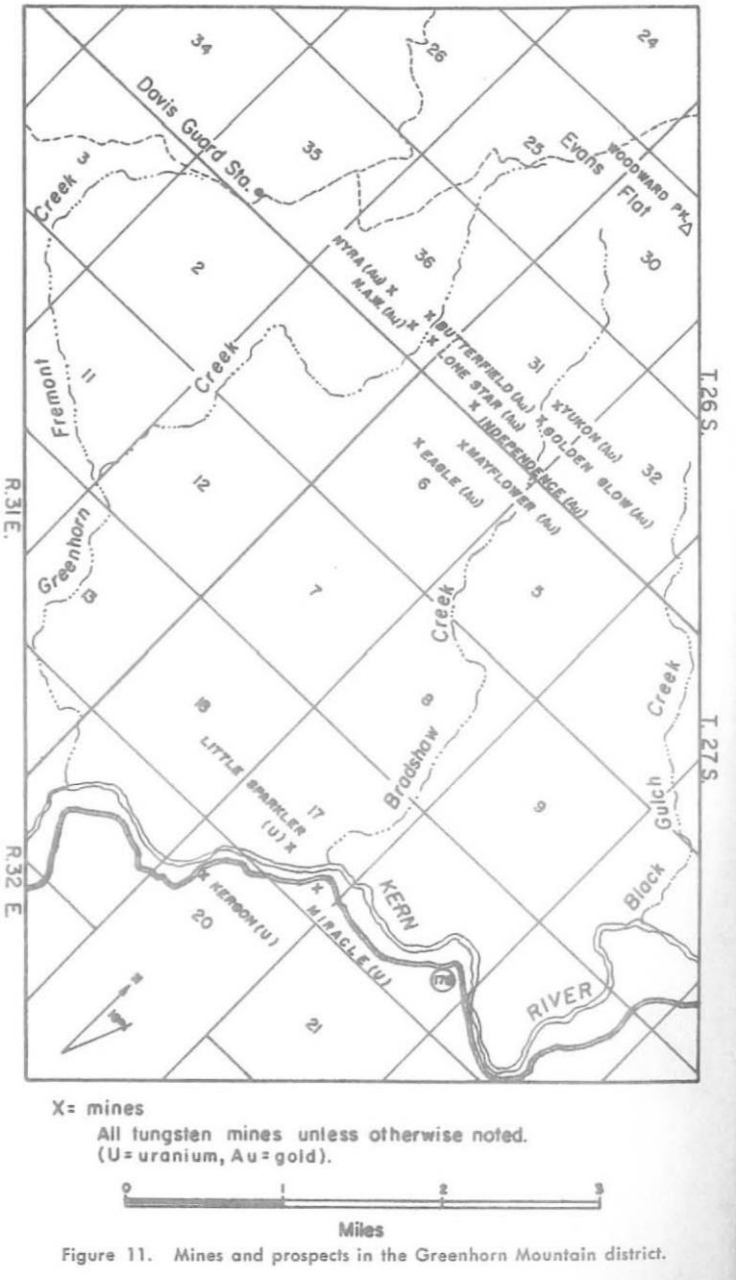


Figure 11. Mines and prospects in the Greenhorn Mountain district.

Figure 20.Greenhorn Mining District (from Troxel and Morton, 1968, p. 34).

Most of the veins are within a 4 -square mile area, the center of which is 2 miles east of David Guard Station. The veins are quite numerous and widespread, but generally are weakly mineralized, narrow, and discontinuous. These features are reflected by the many shallow prospect holes and in the low productivity of the district. Subsequent intermittent and small scale attempts to mine gold from lode and placer deposits have been mostly unsuccessful. As most of the mining in this district was done prior to 1890, no accurate production statistics are available.

Greenhorn Creek is to the north, across the Kern River. The Greenhorn “caves” are 100 yards up this stream. The caves are a group of large boulders and a popular caving

site. This stream is a good example of a “beheaded or pirated stream”. The original stream flowed in an easterly direction. The uplift of the Sierras caused the Kern River to erode deeper into the Greenhorn Creek system pirating the creek. The flow direction of the creek changed to the west.

## AREA MAP 06

0.0 Highway 178 and Old Kern Canyon Road

1.2 Mill Creek Trailhead

2.6 Road on left goes north and downhill to Delonega Hot Springs

## STOP NO. 4 KERGON AND MIRACLE MINES

6.3 Kergon Uranium Mine.

Kergon Uranium Mine is on the left (north side of Kern river). This mine was discovered in May 1954. Two railroad carloads of uranium ore were produced. The principal uranium mineral is autunite, with lesser amounts of uranophane and uraninite [pitchblende]. The mineralization is in a crushed zone of altered quartz diorite between two faults. The Kergon Uranium Mine was worked to a depth of 100 feet below the surface.

Figure 21. Kergon Uranium Mine tailings. View from Highway 178 looking south. Photo by Gregg Wilkerson January 1, 2003.

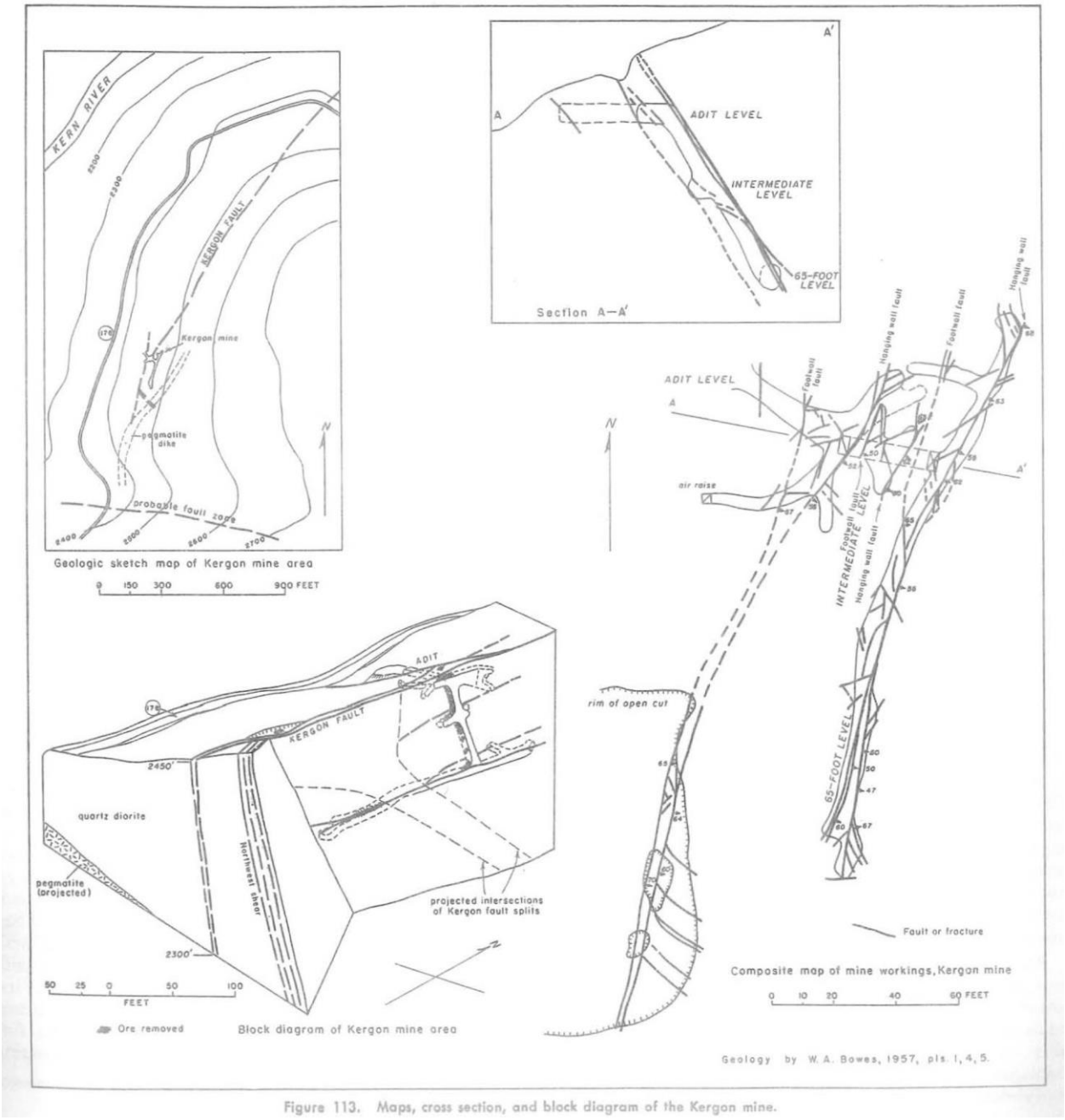



Figure 113. Maps, cross section, and block diagram of the Kergon mine.

Figure 22. Kergon Uranium Mine. From Troxel and Morton, 1968.

10.5 Miracle Uranium Mine. Miracle Uranium Mine is on the right (south side of Kern river). This mine was discovered in January, 1954. Two railroad cars of ore were shipped. One carload had 48.6 tons of ore /that averaged 0.62% autunite and the other had 42.6 tons that averaged 0.18% autunite. It occurs as a filling in a fault zone 3 feet wide in altered quartz diorite. The largest excavation in the mine is a 395-foot long drift.

Figure 23. Miracle Mine Tailings. Photo by Gregg Wilkerson, January 1, 2003.

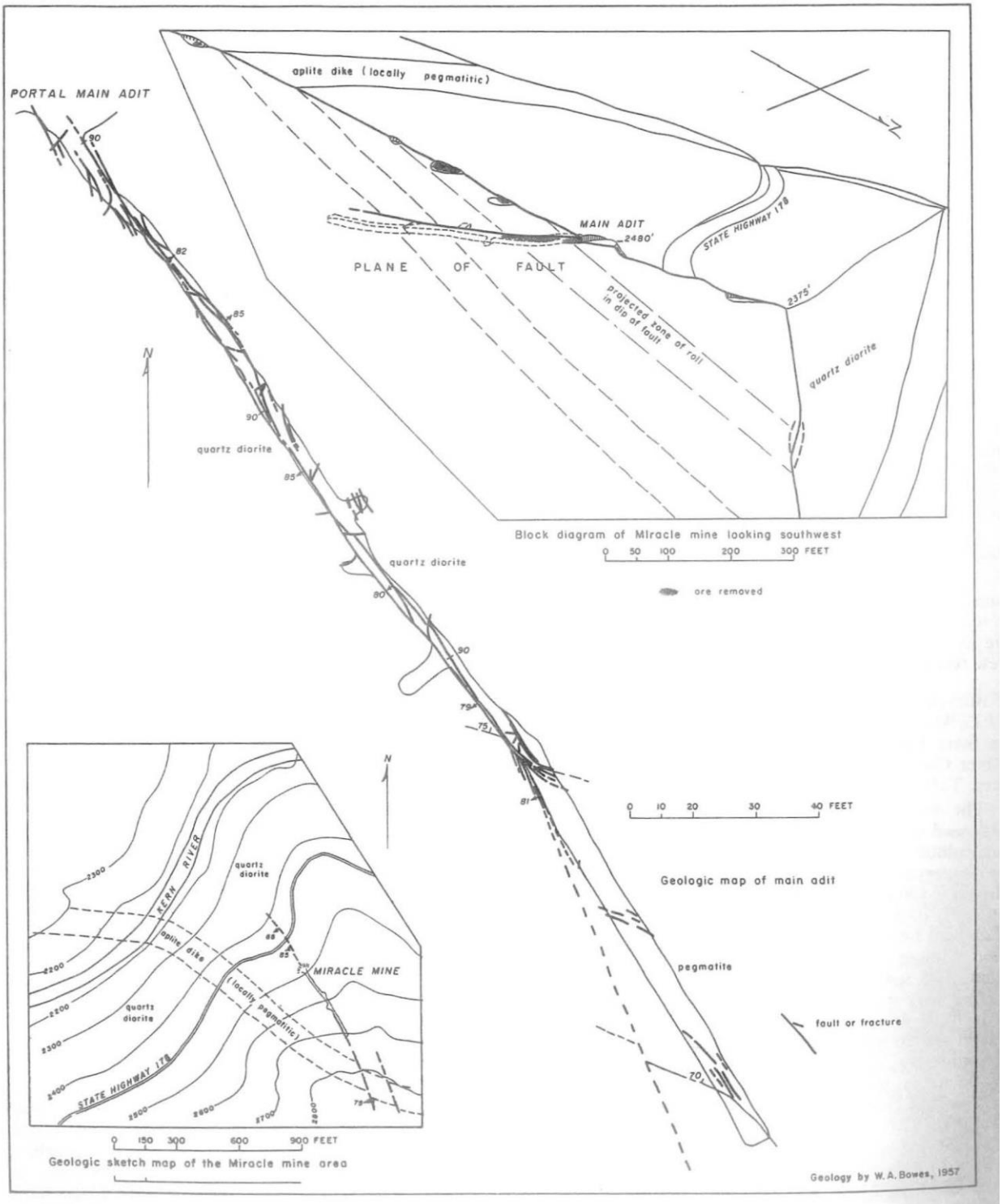



Figure 116. Maps and block diagram of the Miracle mine.

Figure 24. Miracle Uranium Mine. From Troxel and Morton, 1968, p.334.


Kergon Uranium Mine

Miracle Uranium Mine

Figure 25. Kergon and Miracle Uranium Mines. Photos by Gregg Wilkerson, 1993.

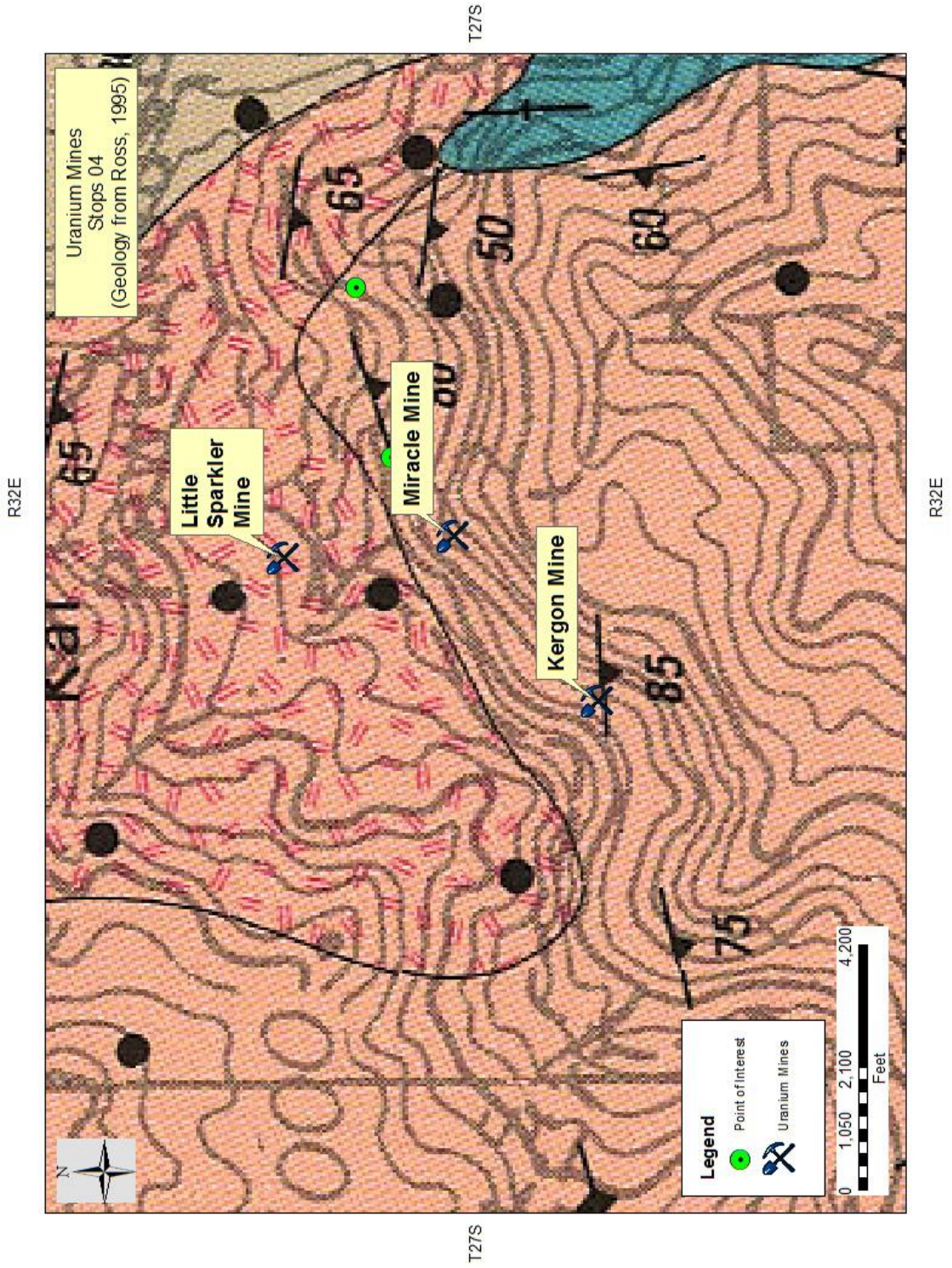



Figure 26. Geologic map for the Kergon, Miracle and Little Sparkler Uranium Mines. Geology from Ross, 1995.

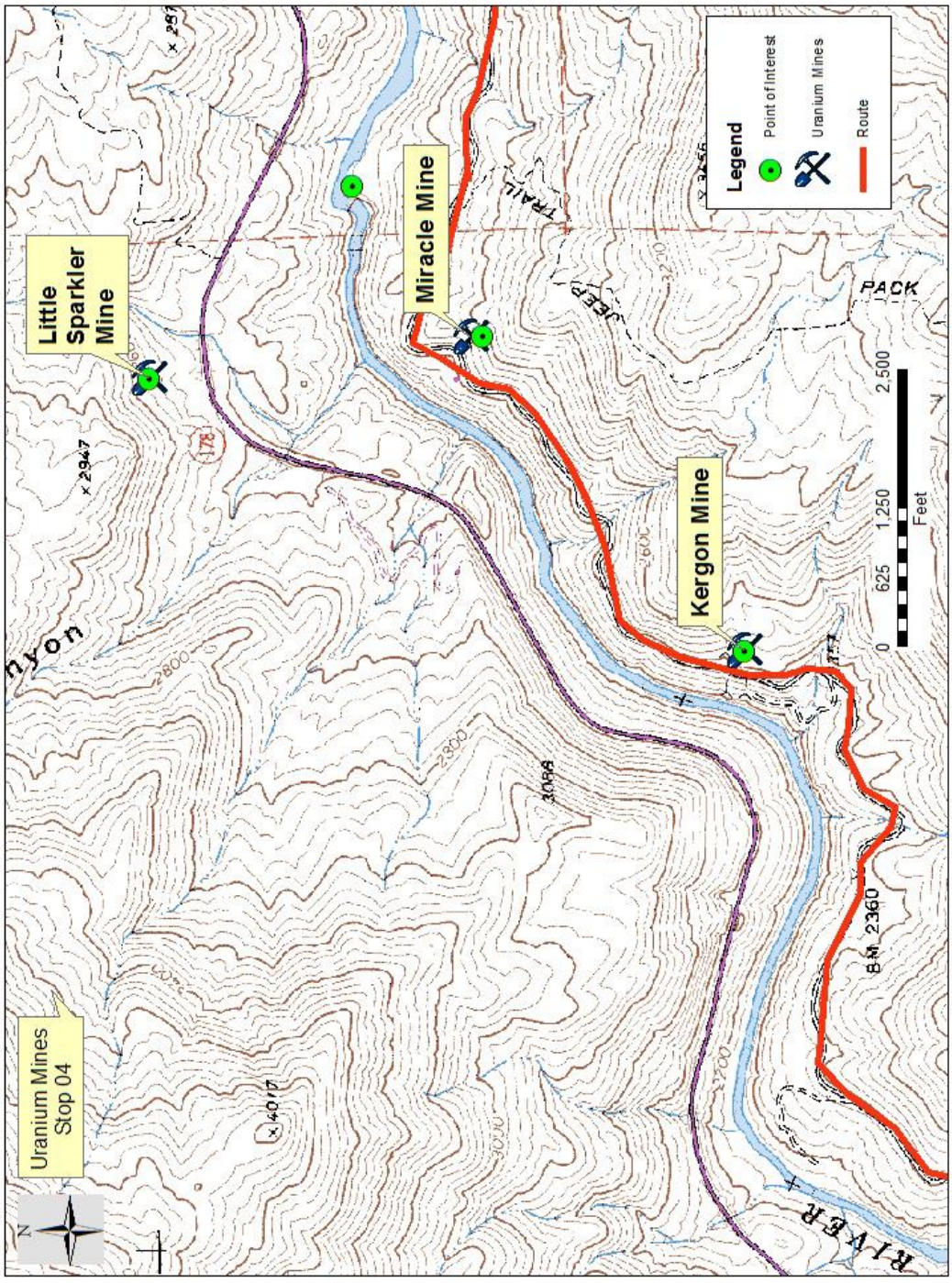



Figure 27. Topographic map of the Kergon, Miracle and Little Sparkler Uranium Mines.

## LITTLE SPARKLER MINE

Little Sparkler Mine and the old access road for the Little Sparkler Mine is across the Kern River to the left (north). This mine is in the same fracture zone as the Miracle Mine.

The Little Sparkler was discovered in early 1956 after the discovery of the Miracle Mine, 2000 feet to the east on the opposite side of the Kern River. A total of 272 tons of ore averaging 0.50% autunite was produced. Secondary uranium minerals of pitchblende (uraninite) and coffinite occur in the fault zone.

**Figure 115 (below). View to south of the Little Sparkler mine. Stope to the surface from the 60 level is in center within fenced area.**

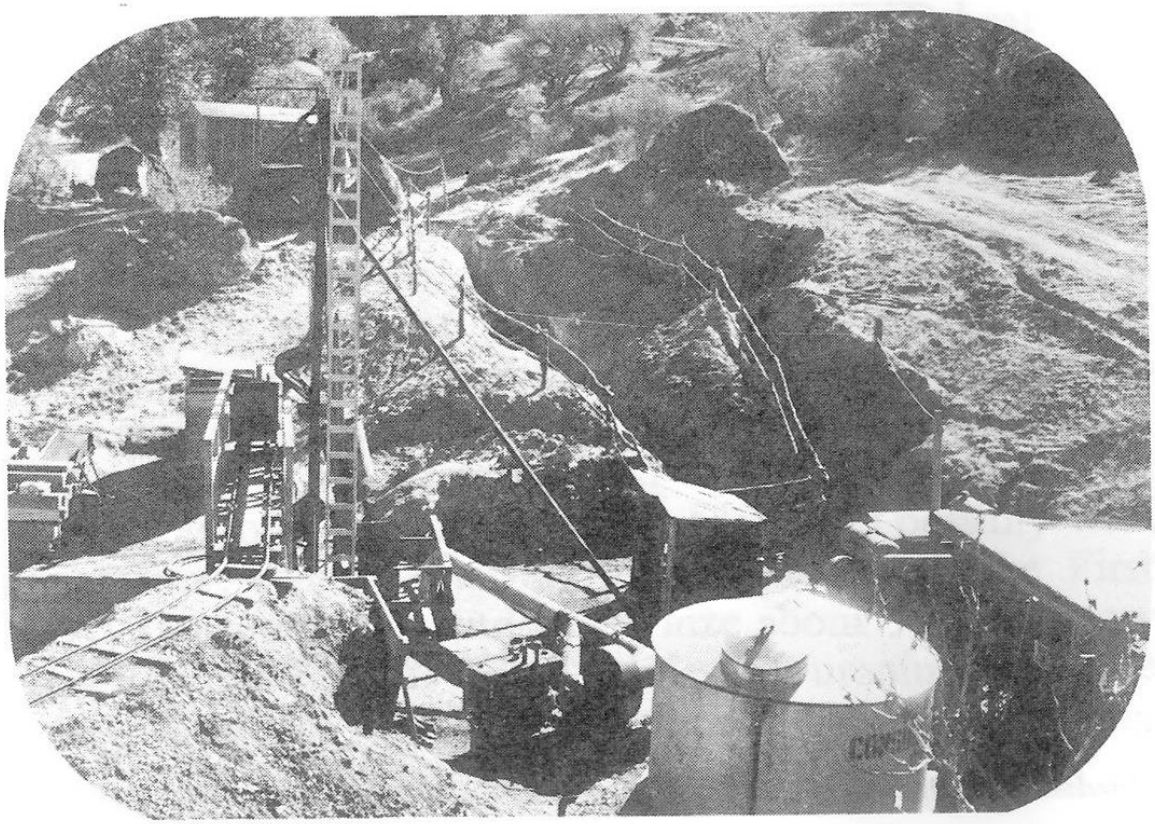


Figure 28. Little Sparkler Uranium Mine. Photo from Troxel and Morton, 1968.

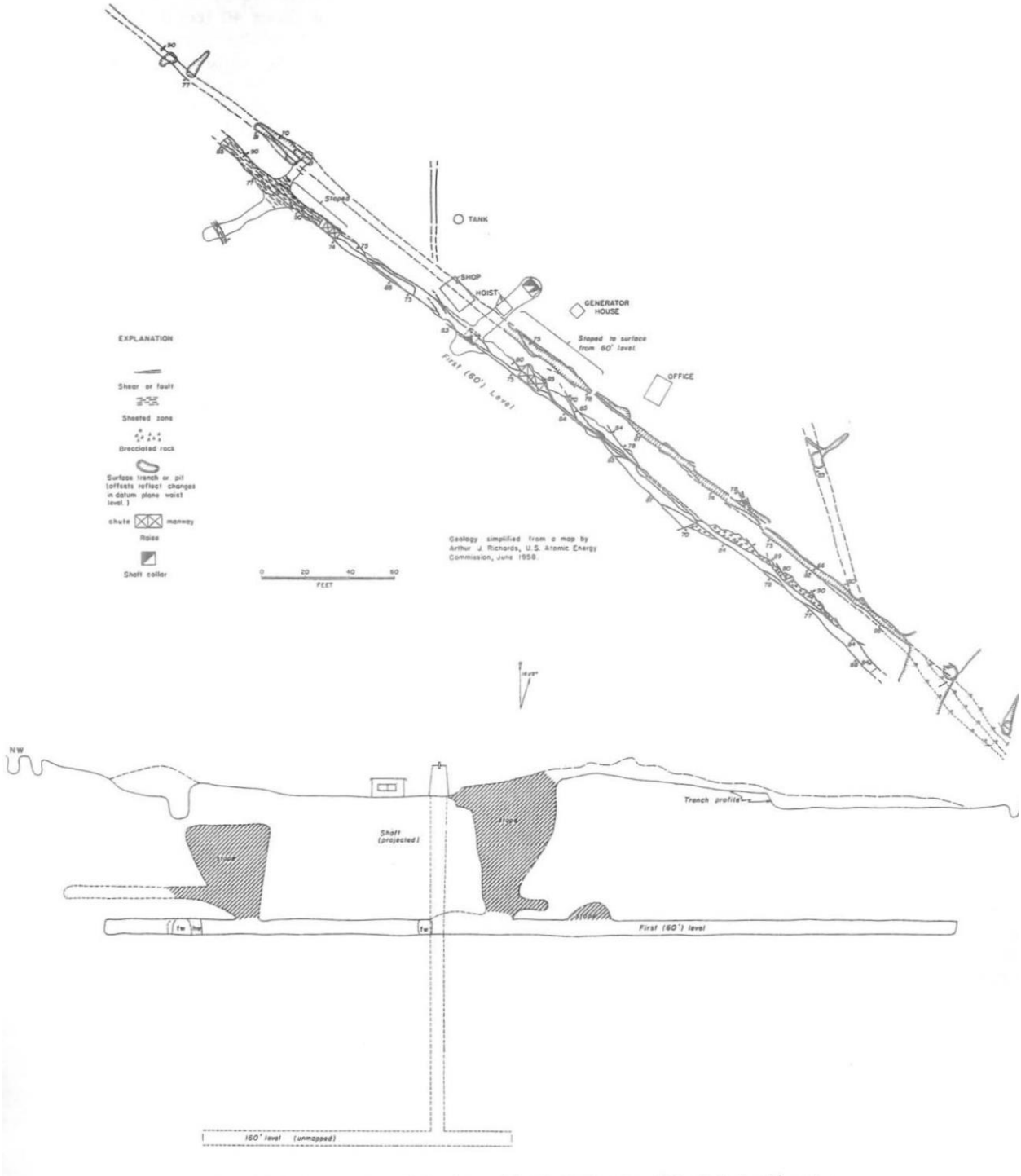



Figure 29. Little Sparkler Mine, From Troxel and Morton, 1968.

## STOPS NO 5. AND NO. 6: REMINGTON AND MIRACLE HOT SPRINGS

Miracle Hot Springs was a thriving resort from 1933 to 1989. The resort went bankrupt and the area was taken over by the U.S. Forest Service. A volunteer group kept hot baths operating for a few years. But his phase of operations was shut down by the U.S. Forest Service and Kern County Department of Public Health because the hot springs were contaminated with petroleum products leaking from an uphill fuel tank, with bacteria, and with radon gas. From the parking lot you can walk down to the river and put your hand in the warm water coming from the still-active hot springs.

10.9 Road to Remington Hot Springs

12.2 Miracle Hot Springs exit. There is a parking lot here. Walk down the path to see the hot springs

Miracle Hot Springs was also known as Hobo Hot Springs, Compressor Hot Springs, and Clear Creek Hot Springs. Prior to 1914, the hot springs at Miracle have had no reported utilization, except for possible a weary miner or Indian who happened to take an occasional bath at the site. The inscription on two concrete tubs (now removed) indicated construction on March 10, 1914. From that time until the area was closed due to health and safety violations by the Kern County Health Department in the 1980's, the springs have been used for balneological purposes.

Figure 30. Miracle Hot Springs. From https://www.cabrillo.edu/~rnolthenius/astro28/a28g/miracle1.jpg Accessed Oct. 27, 2017.

Remington Hot Springs is a mile west of Miracle and is on the Kern River. It has become a local replacement for Miracle Hot Springs.

Figure 31. Remington Hot Springs. From http://totalescape.blogspot.com/2008/02/kern-river-hot-springs.html accessed Oct. 27, 2017

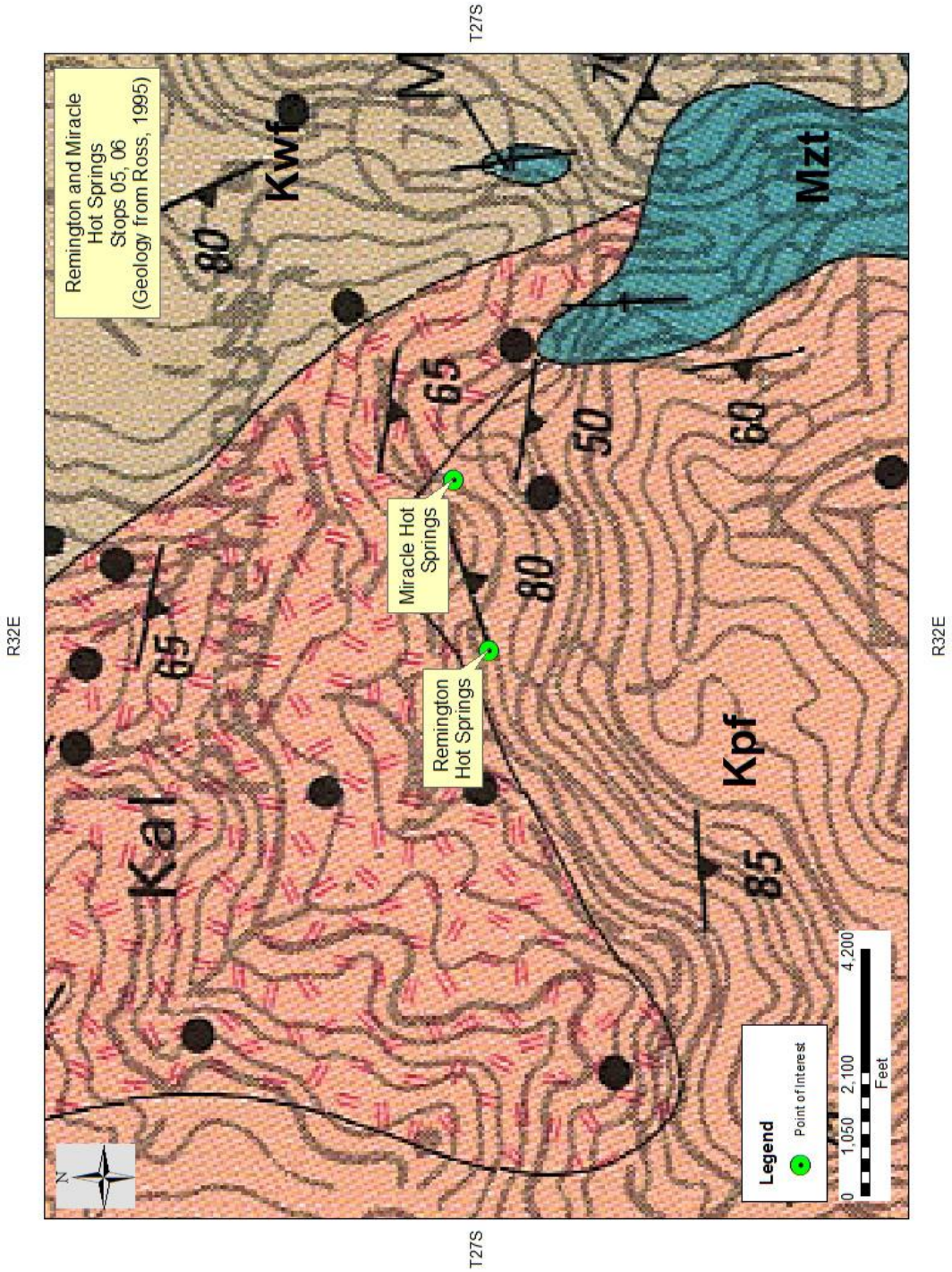



Figure 32. Geologic map of Remington and Miracle Hot Springs. Geology from Ross, 1995.

0.0 Reset Odometer, leave the Miracle Hot Springs Parking lot. Turn left and east toward Lake Isabella

0.2 Poso Flat – Waggy Flat geologic contact at Hobo Campground.

1.4 Borel Power House

BOREL POWER PLANT

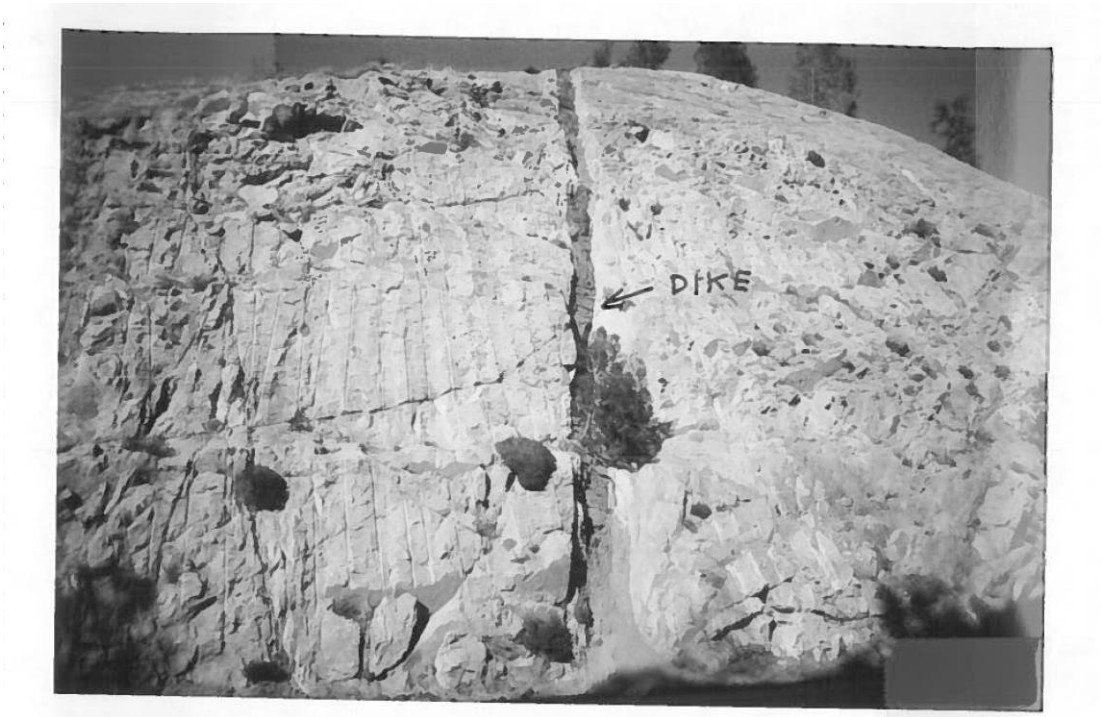
Borel Powerhouse on right (east) is built on Mount Adelaide Granodiorite. This plant was built in 1904 and is currently in the process of being decommissioned

Figure 33. Borel Power Plant circa 1920. From Kern County Mineral Collection.

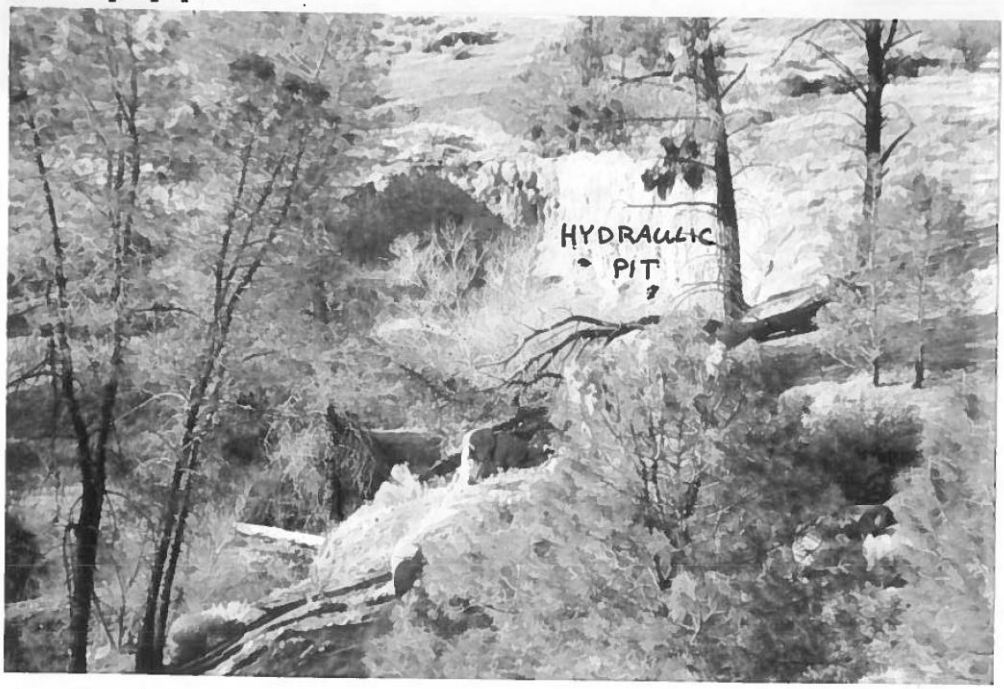
https://calisphere.org/item/ark:/13030/kt409nd30q/ accessed Oct. 27, 2017.

North of the Borel Power House is a bridge crossing Highway 178. This is the "Borel Loop" part of the Kern River which was another placer area. On the north side of the bridge are remnant gravels from pre-1890 hydraulic mining operations. In the road cut on Highway 178 west of the Borel Bridge is an interesting vertical

lampophyre dike.




Black lamprophyre dike




Hydraulic mining in Borel loop. View is northwest from Borel Loop Bridge.

Figure 34.Lampophyre dike on Highway 178 east of Borel Power

Plant and Hydraulic pit east of the Borel Bridge.

3.4 Intersection of Bodfish-Havilah Road and the Old Kern County Road. Turn left and go northwest to County Park.

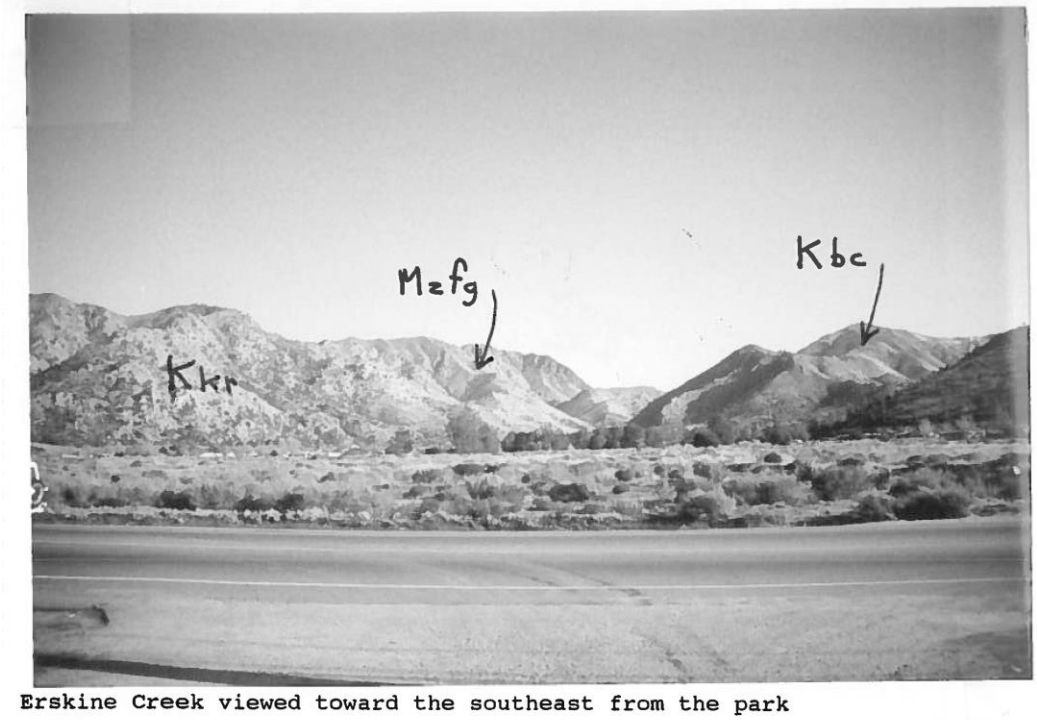
## AREA MAP 07

4.9 Uffort County Park, Lake Isabella

## ISABELLA PARK

At this stop we join the rest of the group at Isabella Park (Uffort Park). This park has military amphibious vehicles and tanks in front of it.

Lake Isabella Park




Erskine Creek viewed toward the southeast from the park

Figure 35. Lake Isabella Park and view to east of Erskin Creek.

East up Erskine Creek are the ultramafic formations. The front hills to the southeast

are Fairview Quartzite. South and to the east (left) toward Havilah is Bodfish Gabbro. To the west (right) is the Alta Sierra Granodiorite and to the southwest is the Mount Adelaide Granodiorite. The Kern Canyon Fault runs through the wind gap and the valley along the line of hot springs.

The Kern Gorge of the river (in front of the dam) and Keysville to the west lie in the Granodiorite of Alta Sierra. South of Keysville is the Granodiorite of Mount Adelaide. The hill to the south and southeast (left) is Quartzite of Fairview. In the upper mountains, south of the Quartzite of Fairview toward Havilah is Olivine Gabbro and Related Rocks of Bodfish. East up Erskine Creek is the Granite of Bodfish Canyon and ultramafic type formations, Metavolcanic Rocks of French Gulch and Quartzite of Fairview. To the east is the Granite of Kern River.

The earliest movement on the fault is estimated to have occurred 90 million years ago. The last movement could not have occurred prior to 3.5 million years ago, as a basalt flow dated at that age covers an elevated erosion surface truncated by the fault. In 1983, the Kernville area was rattled by a series of earthquakes that started in the fall. The largest event was N = 4.7, which was centered near Big Meadow about ten kilometers east of the Kern Canyon Fault. To associate tremors with the Kern Canyon Fault would require a rather low dip on the fault. In 1868, six severe earthquakes with more than 500 aftershocks occurred in the Kernville area. The largest estimated magnitude was 6.5.

The 1868 events were assumed to be on the Kern Canyon Fault, but now in the analysis of the 1983 events, it appears that the 1868 epicenters were most likely located near the recent activity. A large liner trend appears to be developing about 6.21 miles (10 kilometers) east of the Kern Canyon Fault Zone (Ross, 1986)

## ROOF PENDANTS

A north-trending belt of roof pendants occupies a 50 mile-long and 25 mile- wide segment in the middle of the southern Sierra Nevada. Roof pendants are downward projections of country rock into an igneous intrusion. The pendants within it are lenticular or elongate to very irregular in plan. Most of the metasedimentary rock is contained in about 15 pendants, each 4 or more miles long and half a mile or more wide.

The largest pendant, in the vicinity of Isabella, is about 25 miles long and 4 miles maximum width. Most of the pendants trend approximately northward, some are oriented slightly west or east of north, and a few trend east. The pendants are chiefly mica schist, quartzite, and hornsfels, but most also contain carbonate rocks.

These carbonate rocks appear from surface exposures to comprise 15 to 30 percent of the volume of the major pendants. The carbonate rock bodies are lenticular and range in size from lenses only a few tens of feet long to elongate bodies as much as 6 miles long and half a mile wide. Much of the carbonate rock is intimately mixed with schist and quartzite and much is dolomitic or dolomite. In many places the dolomite occurs as irregular replacement patches in limestone. In other places entire masses of carbonate rock are dolomitic.

The limestones are mostly white to bluish-gray, thick-bedded and fine to moderately coarse grained. Beds of white limestone, as much as several feet thick, are interlayered with bluish-gray and banded white limestone. Minable bodies of this limestone, of commercial grade and as much as 300 feet thick, were first mined for paint manufacture in 1958 when the Kennedy Minerals Company opened a small quarry 6? miles east of Isabella.

Large bodies of metamorphic rocks in the areas adjacent to the valleys of the Main Fork and South Fork of the Kern River and in the Piute Mountains, in the central Sierra Nevada, were named the "Kernville series" by Miler in 1931, and later mapped by Miller and Webb in 1940. The series is made up largely of phyllite, quartzite, and crystalline limestone and dolomite.

To the north, on the other side of the Kern River is the Keyesville Mining District.

## ERSKIN CREEK MINING DISTRICT

To the south and the west is the Erskinee Creek Mining District (Figure 22). Erskinee Creek, a north west-flowing tributary to the Kern River, cuts through a north-trending roof pendant of pre-Cretaceous metasedimentary rocks that contains deposits of tungsten, gold, silver, antimony, uranium, copper, and building stone. These deposits lie within an area about 5 miles long and about 2 miles wide. Center of the area is about 5 miles southeast of Bodfish.

Antimony and gold deposits were productive in the early 1890's and later, though production was probably not large. Copper was discovered before 1904 but as late as 1958 the prospects remained unproductive. Tungsten was produced in the 1940's and 1950's, and probably has the highest total dollar value of materials mined in the district. Uranium mineralization was discovered in 1954, but only several tens of feet of underground workings were driven. Fine grained metasedimentary rocks are mined intermittently from a deposit on Cook Peak and marketed as building stone. A travertine deposit at the mouth of Erskine Creek has been prospected for stone but none has been produced.

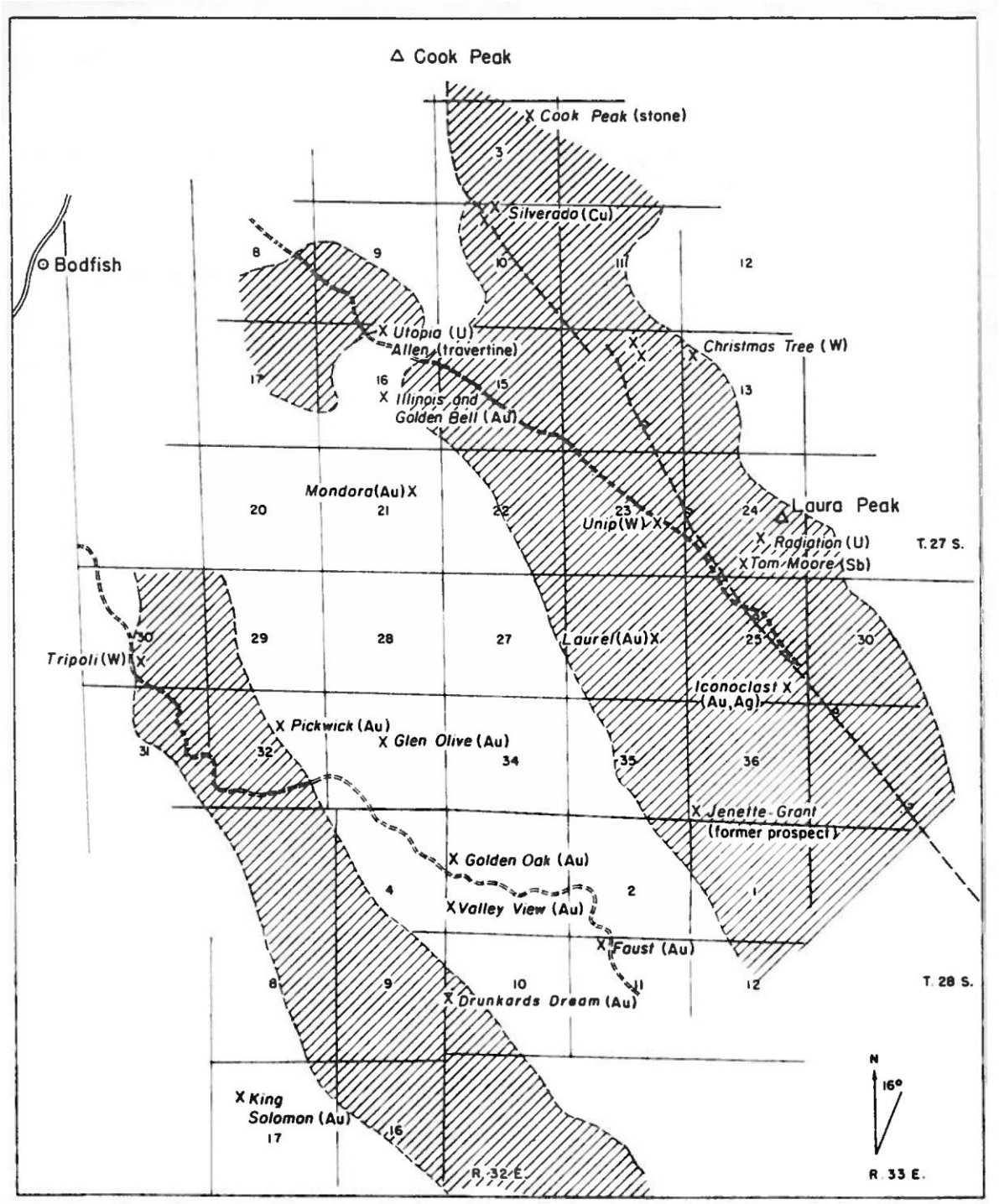



Figure 36. Erskin Creek Mining District. From Troxel and Morton, 1968.

0.0 Reset Odometer at Lake Isabella (Uffort) Park and Pearl Harbor Memorial.

Leave Lake Isabella Park, turn left, go north toward downtown Lake Isabella.

1.0 Rolling stop to view Isabella Hot Springs (PRIVATE) on right (east). This artisan hot spring was once a spa. Rocks in hill to the east are Granodiorite of Kern River.

## SCOVERN HOT SPRINGS

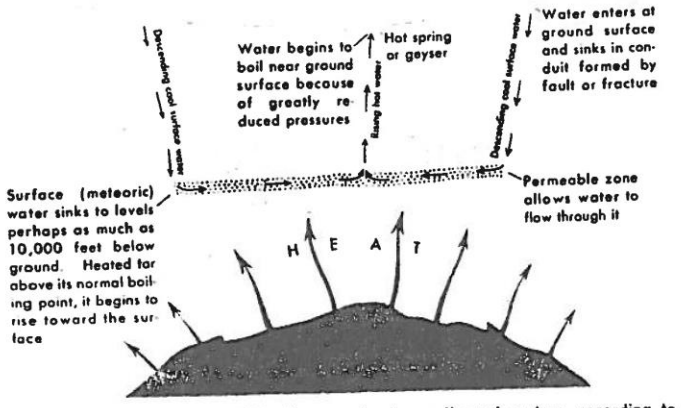
The Lake Isabella valley was originally called Hot Springs Valley in the 1850's. The springs located within the community of Lake Isabella are called Scovern Hot Springs also known as Neills Hot Springs and Agua Caliente. In a sparsely populated area, located east of Lake Isabella Blvd., Scovern Hot Springs used to gush from a large size diameter (2 ft) surface casing, remnants of previous utilization works. Since the time of the Indians and Spanish settlers, the springs have been utilized mostly for balneological purposes. The following is an excerpt from the Visalia W. Delta, June 6, 1866:

"H. Chapman and Thos. Baird, alias Boncs, were advertising the Warm Springs House, Hot Spring Valley, Kern River. The hotel, 7 mi. from Havilah, on Kern River, presented " peculiar inducements to invalids, especially those suffering from chronic diseases." The owners strongly recommended the springs for fever and ague and would "actually guarantee a speedy cure of the most obdurate cases." . were making "extensive additions" and in a few weeks would be able to accommodate "families wishing to sojourn here."

Board and lodging, including the use of baths, cost $15 a week. Hot or cold sulphur baths cost 50 cents. Wines, liquors, and cigars were available.

In 1915, a resort was constructed, complete with baths and swimming pool, but was subsequently abandoned. The water temperature from the two springs ranges from 128.3°F (53.5°C) to 129.9°F (54.4°C) with a flow of 87.1 gallons per minute (330 liters per minute).

Isabella Hot Springs and abandoned spa




HEAT FLOW AND SURFACE WATER. Diagram showing a thermal system, according to the explanation that water of surface origin circulates and is heated at great depths. (Based on information supplied by D. E. White, L. J. P. Muffler, R. O. Fournier, and A. H. Truesdell.)

Typical hot springs diagram

Figure 37. Lake Isabella Hot Springs Resort (abandoned) in 1993 with Hot Spring diagram.

1.5 Highway 155 (Nugget Road) intersection and Lake Isabella Blvd. The Dam

Corner Restaurant is to the northwest.

## PART 2: LAKE ISABELLA TO KERNVILLE CEMETERY

0.0 From the Intersection of Lake Isabella Boulevard and Highway 155, go west on Highway 155 over Highway 178.

0.3 Cross Highway 178

0.6 Kern Canyon Fault. The shear zone is exposed through this road cut.

0.8 Turn off to U.S. Forest Service Ranger Station. Go north to the U.S. Forest Service Office. Park in the Parking Lot.

1.6 Lake Isabella Forest Service Ranger Station.

### STOP NO. 7: ENGINEERS POINT AND KERN RIVER FAULT

To the north of the Forest Service Ranger Station is a long peninsula known as Engineer's Point. The peninsula is the silicified Kern River Fault Zone.

The near vertical to vertical fault zone enters the lake here and follows the North Kern River bed. The fault splits into two branches near Wofford Heights. The split branch to the west is called the Big Blue Fault Zone and is located above the lake level within Wof ford Heights and rejoins the main zone north of Kernville. The main Kern Canyon Fault follows the North Kern River.

When Lake Isabella Dam was built in 1952, this fault was categorized by the California Geological Survey as an inactive fault. Since then mapping in Sequoia National Park, and mapping of the Lake Isabella area by students from California State University Bakersfield have indicated that this fault has moved in the past 5,000 years and hence is now classified as an active fault. Small earthquakes (M2.0-3.0) occur regularly in the area of the Kern Canyon Fault from Sequoia National Park down to Caliente.

The Kern River Fault has right—lateral offset of at least 9.32 miles (15 kilometers)

and is about 124.27 miles (200 kilometers) in length. The zone is one of the largest structural features located entirely within the Sierras. The Kern River Fault enters the area of Kern River Valley from the south along the Bodfish-Havilah Road, through the Borel tunnel, along Hot Springs Valley on the west side, within the ridge between the two dams, and under the lake bed to north of Kernville. In the north—south trending upper Kern Canyon drainage (north of Kernville) the fault parallels the river for 75 miles (120 kilometers).

The rocks at Engineer's Point, outside the fault zone, are Granodiorite of Wagy Flat (Ross, 1995)

Location of the new Alta Sierra Powerhouse is below the west dam.

Figure 38. Alta Sierra Power Plant at West Lake Isabella Dam. Photo by Gregg Wilkerson Dec. 31, 2008.

The original town of Isabella was located beneath the lake, north of the auxiliary dam

(southern dam) , at the junction of the north and south forks of the river. On the east (right) is Cook Peak, which is within the Cretaceous Granodiorite of Kern River. The lake has a storage capacity of 550,000 acre feet.

The Black Jack/Summit group of claims were located about 2½ miles southeast of old Isabella. The claims were located in an east striking 2000-foot long vein of lend and zinc within limestone. Production was thirty tons of ore shipped in 1928.

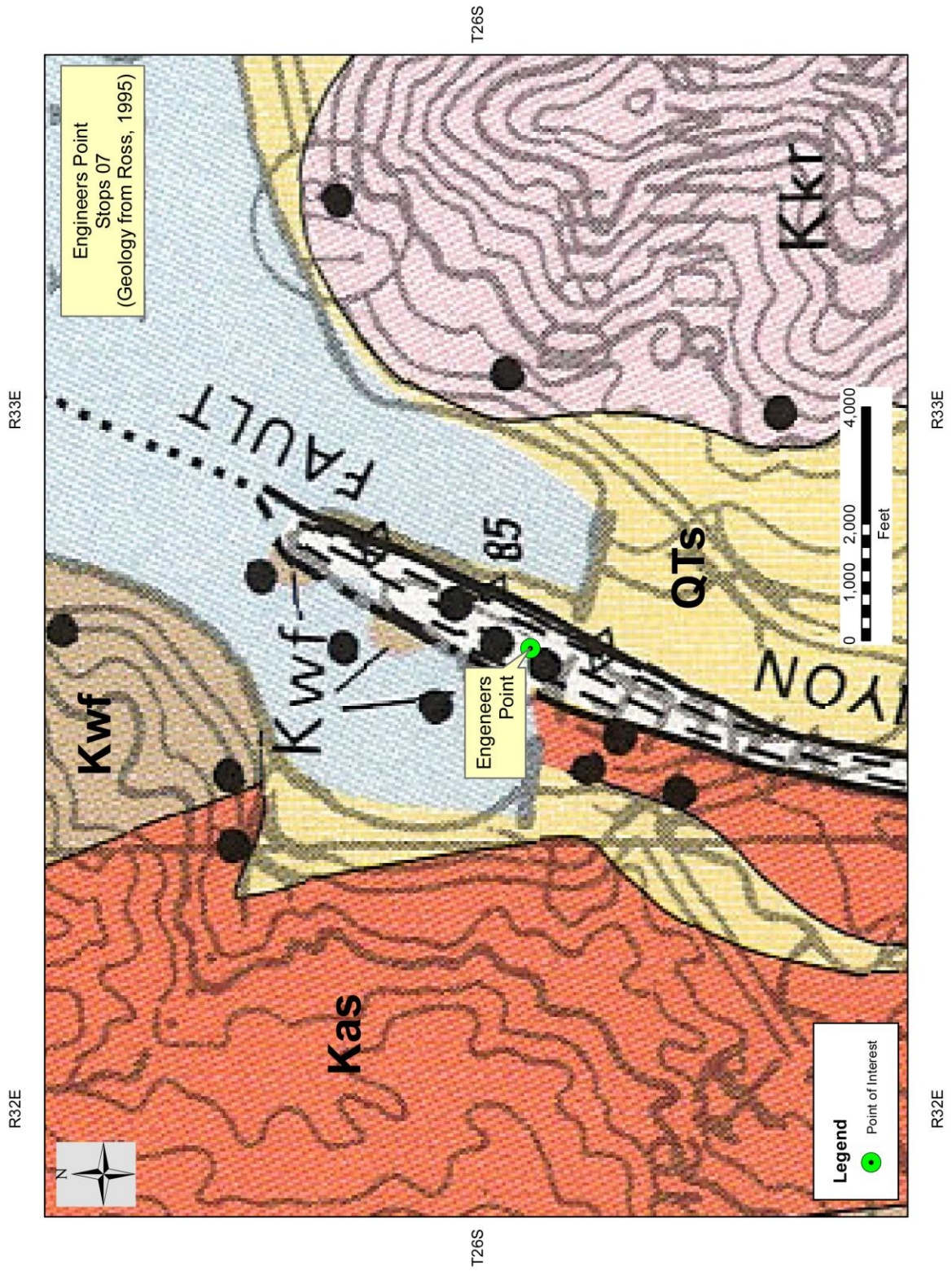



Figure 39. Geologic Map of Stop 7.

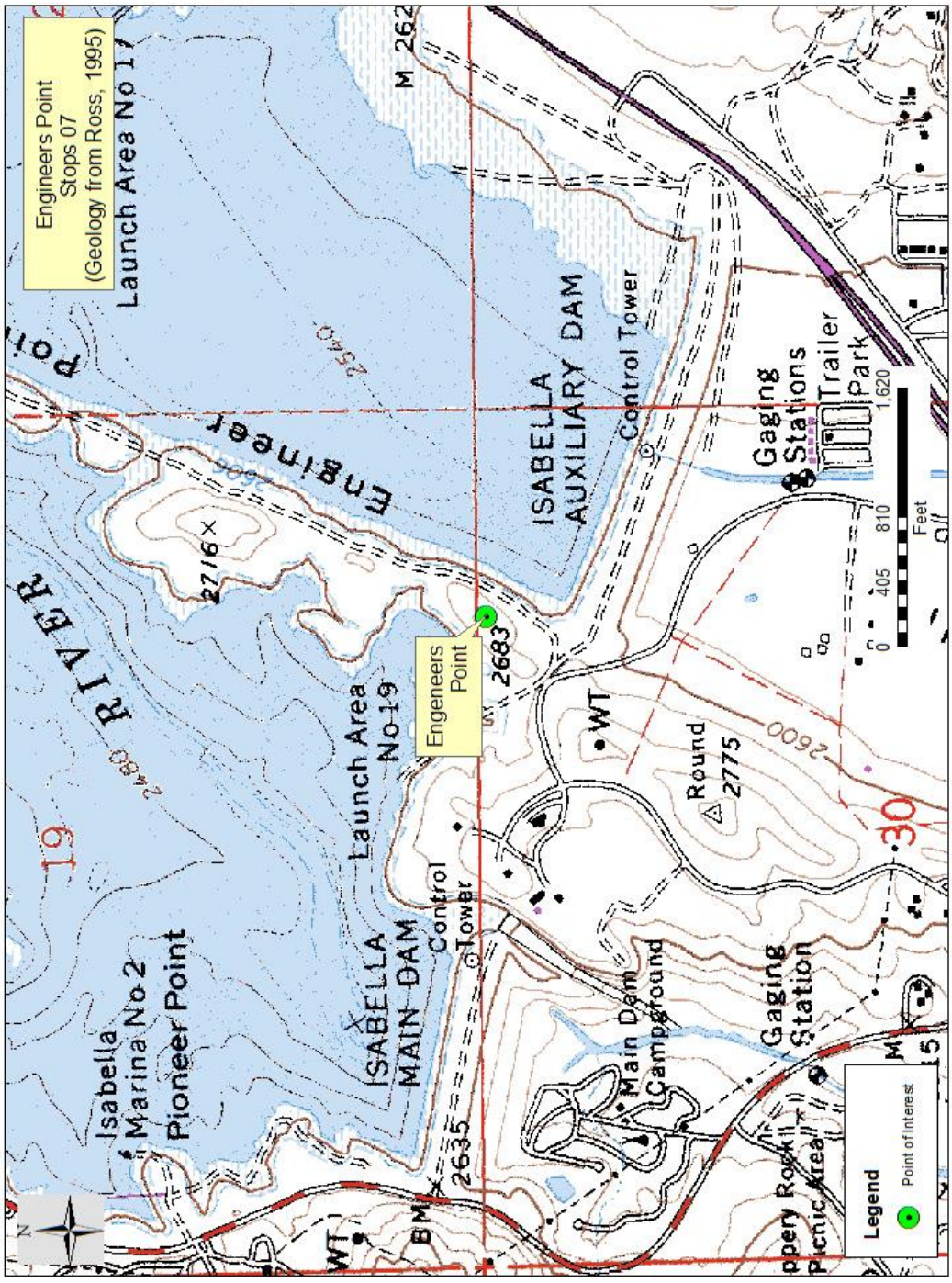



Figure 40. Topographic map of Stop 7.

RETURN TO HIGHWAY 178

0.0 Forest Service Ranger Station Road and Highway 155. Head northwest toward Wofford Heights.

0.4 Kern River Bridge. Note the key cut into bedrock. This was a bedrock flume that was used by a mill that once occupied this position on the river.

0.7 Keyesville Recreation Area (northern entrance).

Turn left and go south on the Keyesville Road. Go south to Pearl Harbor Drive.

This is the road entrance to the abandoned gold town of Keyesville which existed between the years of the 1851 to the 1895. In the 1850's a haphazard collection of buildings took on an appearance of a fledgling township with the introduction of two storekeepers William Marsh and William Kennedy. The only dwelling preserved from the gold rush days are some buildings left from the Walker family. The buildings were built on the Brite Spot mining claim and was listed as one of the major gold producers in the Keyesville Mining District in the early years. The Walker family has a colorful but violent history and can be referenced in Bob Powers "Kern River Country" book. The Keyesville Cemetery is of particular interest.

The town of Keyesville was established in 1852, by 1856, the town consisted of four respectable boarding houses, one restaurant, a bowling saloon, a black—smith shop, gunsmith shop, two stores, and a stately house to be used by the citizens for the three-fold purpose of a church, school room, and for public meetings. A post office was established by 1867. Keysville was the most prominent community of the Kern River country until the boom at Havilah in 1867. Keysville has since become a ghost town.

## KEYESVILLE MINING DISTRICT

The Keyesville District is 32 miles northeast of Bakersfield and 2 miles southwest of Isabella Dam. It comprises about 15 square miles, bounded approximately by the Kern River on the southeast, French Gulch on the northeast, and Black Gulch on the northwest and northeast.

Figure 14. Mines and prospects in the Keysville district.

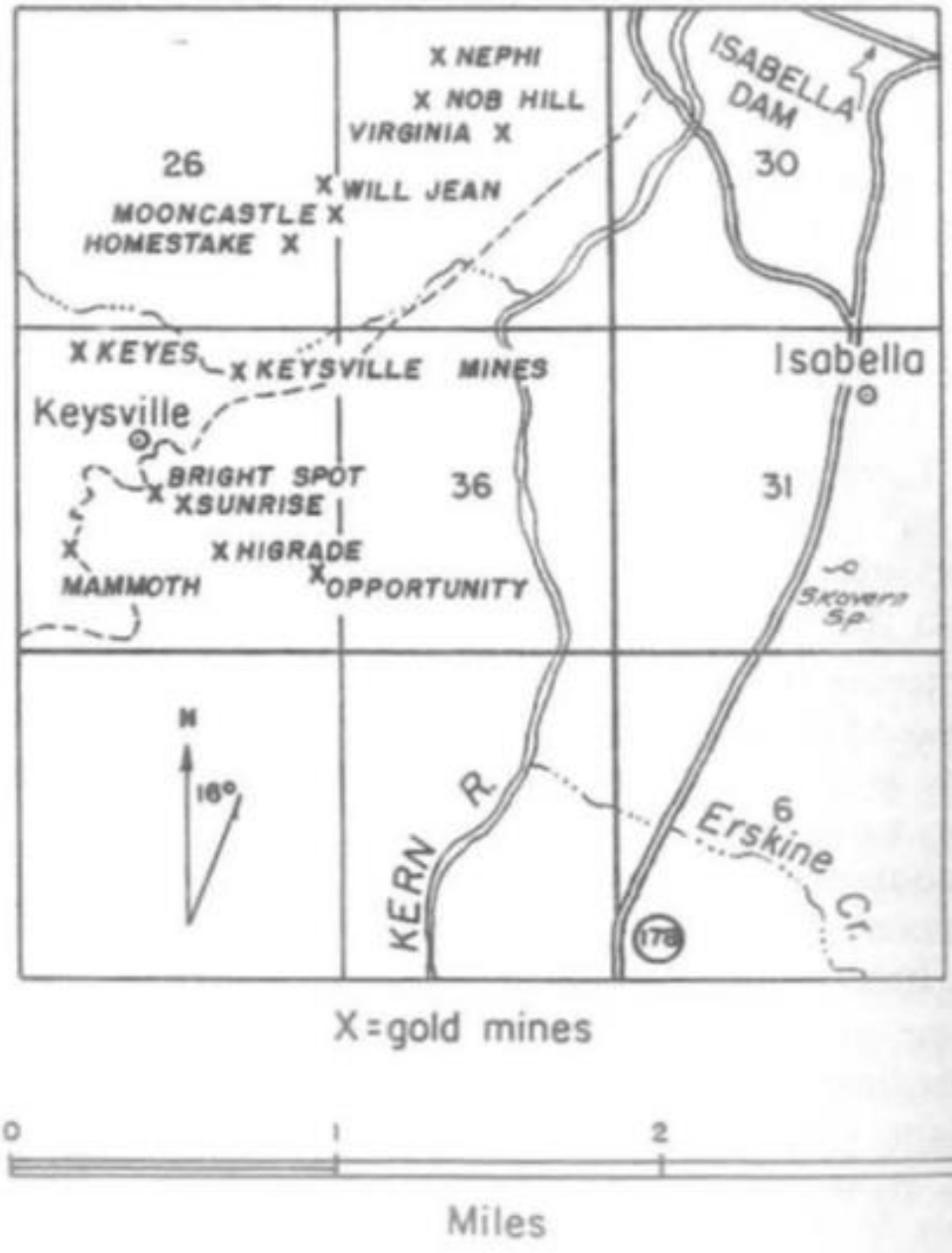



Figure 41. Keyesville Mining District. From Troxel and Morton, 1968, p. 38.

Lode gold was first discovered in this district in 1852 by Richard M. Keyes who located a group of claims later known as the Keyes mine. This and the Mammoth mine, which was located soon thereafter, became the two most productive mines of the district. Subsequent discoveries at the sites of the Pennsylvania, Sunrise, and other mines led to the establishment of Keyesville, the ascendant community of the Kern

River country until the boom at Havilah in 1867. Keyesville, which is 2 miles southwest of Isabella Dam on the west side of Kern River, has since become a ghost town.

The principal periods of mining activity after the 1860's were during the 1890's, from 1909 to 1915, and for a brief time following the rise in the price of gold in 1933. The mines were closed by Presidential order in 1943. After WWII the mines re-opened and operated through 1955.

Most of the deposits in the Keyesvillle Mining Distrtict lie in a mile-wide northeast-trending belt extending 3 miles southwest from Lake Isabella to a northwest-trending ridge overlooking Black Gulch. The veins range in width from 3 inches to 6 feet and each consists typically of a gouge-filled fault zone which contains narrow, discontinuous quartz stringers. In some veins it is associated with sparsely distributed grains of pyrite, arsenopyrite, and pyrrhotite.

2.2/0.0 Pearl Harbor Drive. Reset Odometer

0.6 Keyesville Hydraulic Pit

## STOP NO. 8: KEYSVILLE HYDRAULIC PIT

The canyon here was produced by hydraulic mining. The source of water was a canal on a ridge to the south that also provided water for the Mammoth Mine. Here you see granite bedrock and gravels that lie between it and overlying Lake Ferdinand terrace deposits. There is an island of unremoved terrace material a few hundred feed downstream from Pearl Harbor Drive in which you can see the gravels above bedrock. Further down are cobbles of material on the left (south) side of the drainage that mark where miners removed them from a long tom sluice that discharged sand into a reservoir behind a now-eroded dam.

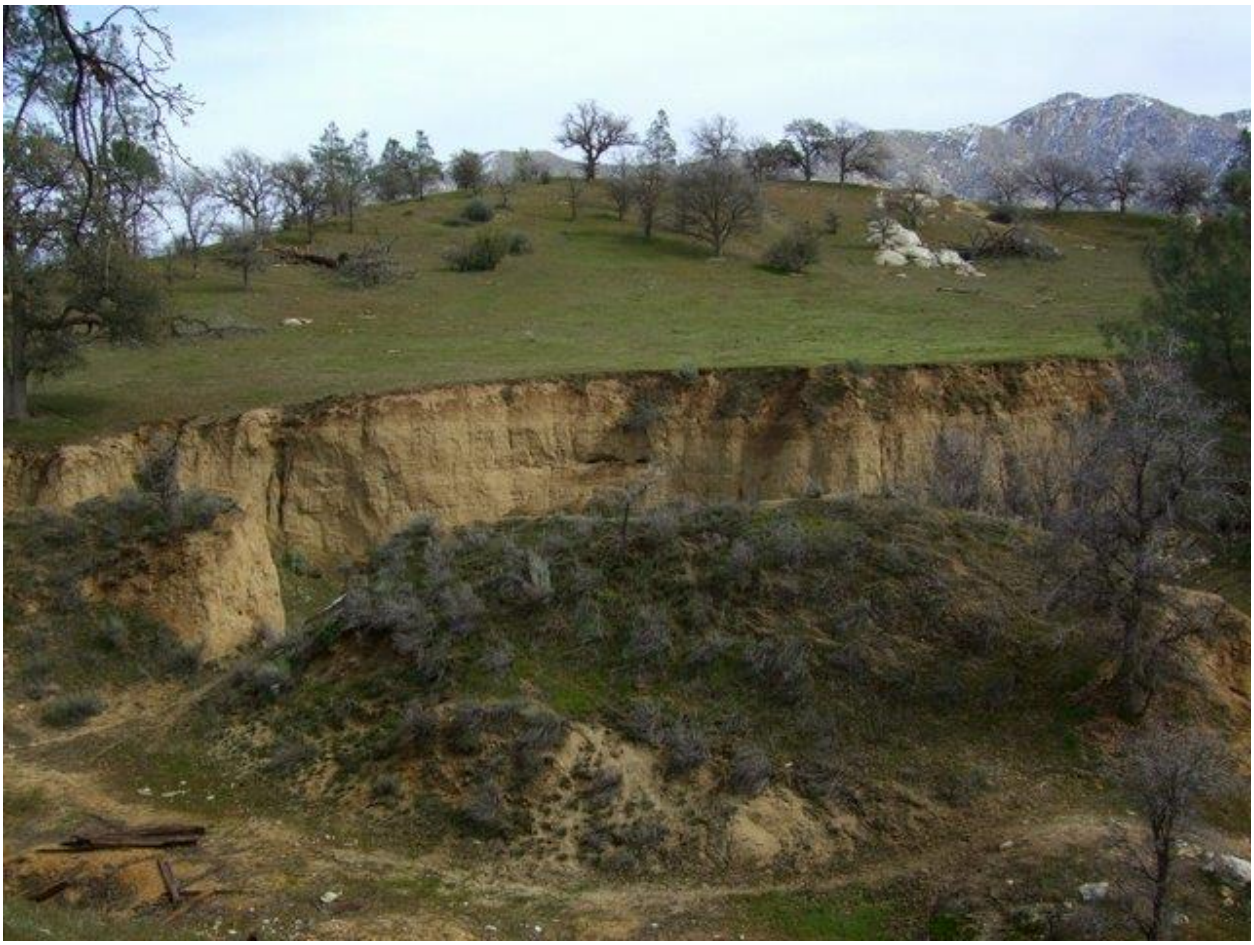


Figure 42. Keyesville Hydraulic Pit showing Lake Ferdinand terrace.

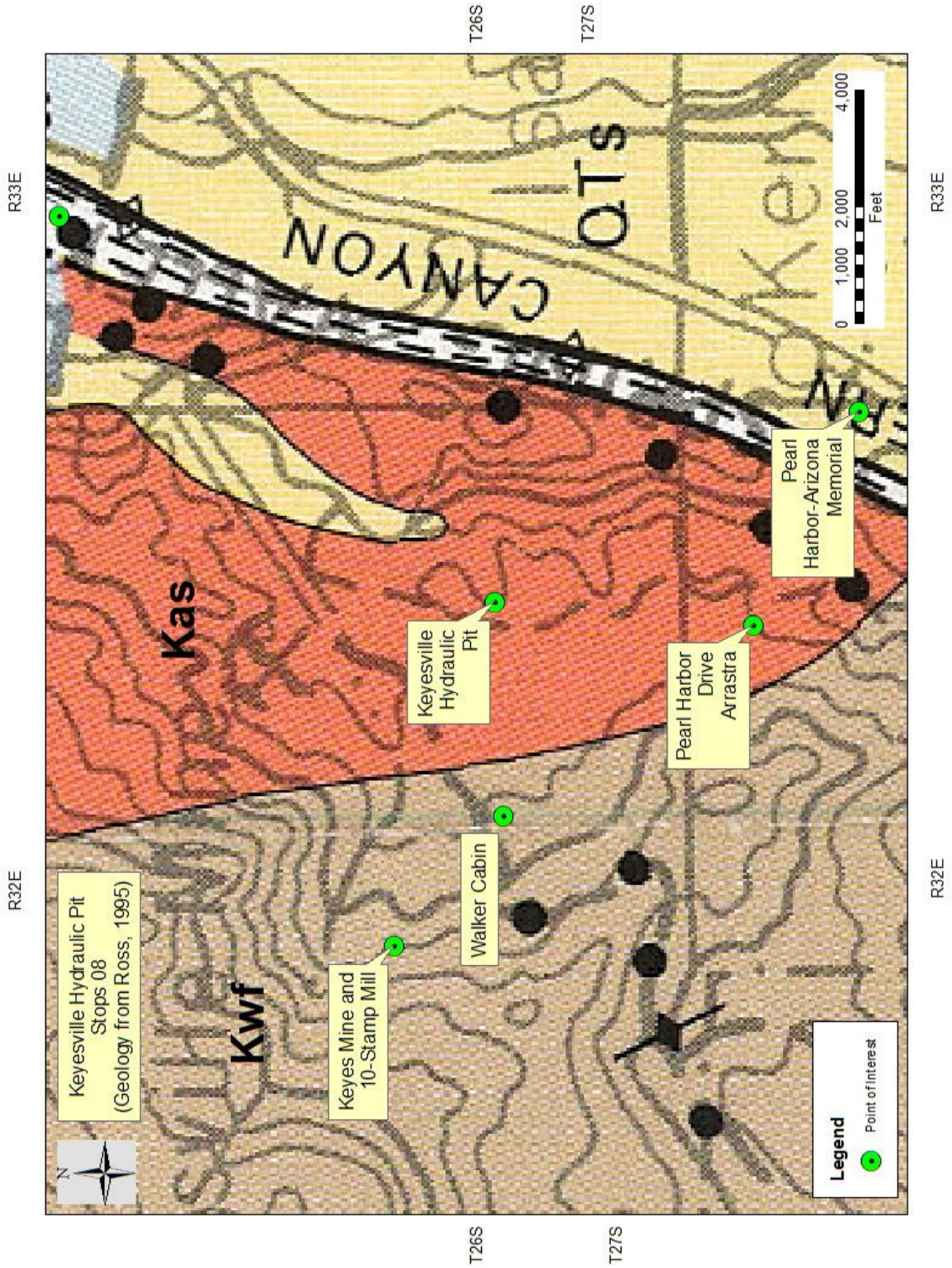



Figure 43. Geologic Map for Keyesville Hydraulic Pit and Surrounding Area, Stop No. 8. Geology adapted from Ross, 1995.

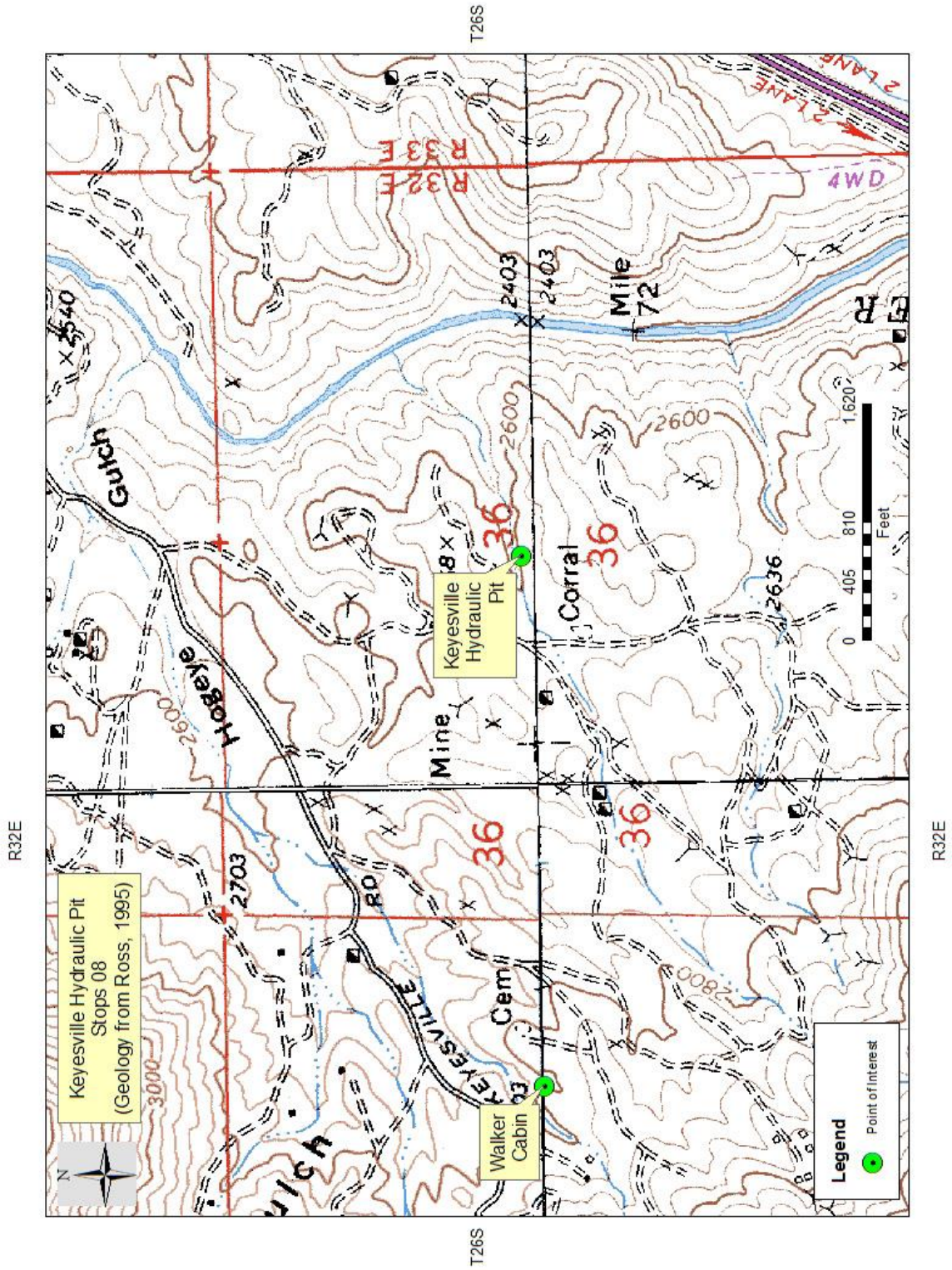



Figure 44. Topographic map of the Keyesville Hydraulic Pit and Surrounding Area, Stop No. 8

Take Pearl Harbor Drive west to return to the Keyesville Road.

0.0 At the intersection of Pearl Harbor Drive and the Keyesville road, turn right and go south to Sandy Flat Exit.

0.3 This Sandy Flat Exit is marked by a Kioske and restrooms on your right (east).

0.6 Sandy Flat

## SANDY FLAT

Take the dirt road on your right (east, then northeast) and go down to the Kern River. Here we encounter another Lake Ferdinand terrace. Look for a big tree near the river. Walk over there and see more gravel on bedrock, and also and pseudo-bedrock near the river. This is a popular place to pan for gold.

RETURN TO THE INTERSECTION OF KEYESVILLE ROAD AND HIGHWAY 155

Turn left and go west toward Wofford Heights.

0.0 Alta Sierra Powerhouse, to the north is under construction, below Isabella Dam on left (north).

0.5 Isabella Dam.

0.8 Pioneer Point Campground.

1.0 French Gulch Creek: Good gold deposits occurred upstream. Water from this area was diverted in the 1850's to Hog Eye Creek from Kennedy Meadows.

1.3 Just north of the bridge which crosses French Gulch there is a contact between Mount Adelaide Granodiorite and Alta Sierra fine-grained Granodiorite. The contact strikes northwest and separates Mount Adelaide to the southwest from Alta Sierra to the northeast.

1.4 Kern Canyon Fault along peninsula on right

1.5 Contact between Alta Sierra fine-grained Granodiorite to west with

Granodiorite of Wagy Flat to the east

2.8 Boulder Creek Campground to the right (east), Hungry Gulch Campground to the left (west).

## AREA MAP 08

2.5 Contact between Quartzite of Fairview to the north and Granodiorite of Wagy Flat to the south.

5.1 Live Oak Campground.

5.6 Wofford Heights. At the east end of this town is the contact between Quartzite of Fairview and Mount Adelaide Granodiorite

7.2 Old city ruins of Kernville are downhill on the right (east). Drive around ruins. A map of the old townsite is available at the Kernville Museum.

Due to the drought of 1986-1992, the lake level had lowered and exposed the ruins. Many of the old building foundations and roadways have been marked by Historical Society volunteers.

Most of the old townsite is underlain by the Fairview Quartzite. This is an old sand deposit of what has been melted together by high-temperature regional metamorphism to form the very hard and resistive quartzite.

In the south end of the townsite there are small intrusives of Adelaide Mountain Granodiorite.

## OLD KERNVILLE CEMETARY

After returning from the ruins of old Kernville (a.k.a. Whiskey Flat), instead of returning to Highway 155, turn right and go over to the Old Kernville Cemetery. This cemetery is built on a Lake Ferdinand terrace.

## STOP NO. 9: BIG BLUE MINE

The Big Blue mine is between the Kernville Cemetery and the town of New

Kernville. The mine is on private land and permission from the owner is needed to access this mine. The Big Blue veins are associated with a western splay in the Kern Canyon Fault. The host rock is mostly Fairview Quartzite.

The mine was connected to a mill on the Kern River just south of the Old Kernville Cemetery. The grade of that narrow gauge railroad can still be seen on either side of Highway 155.

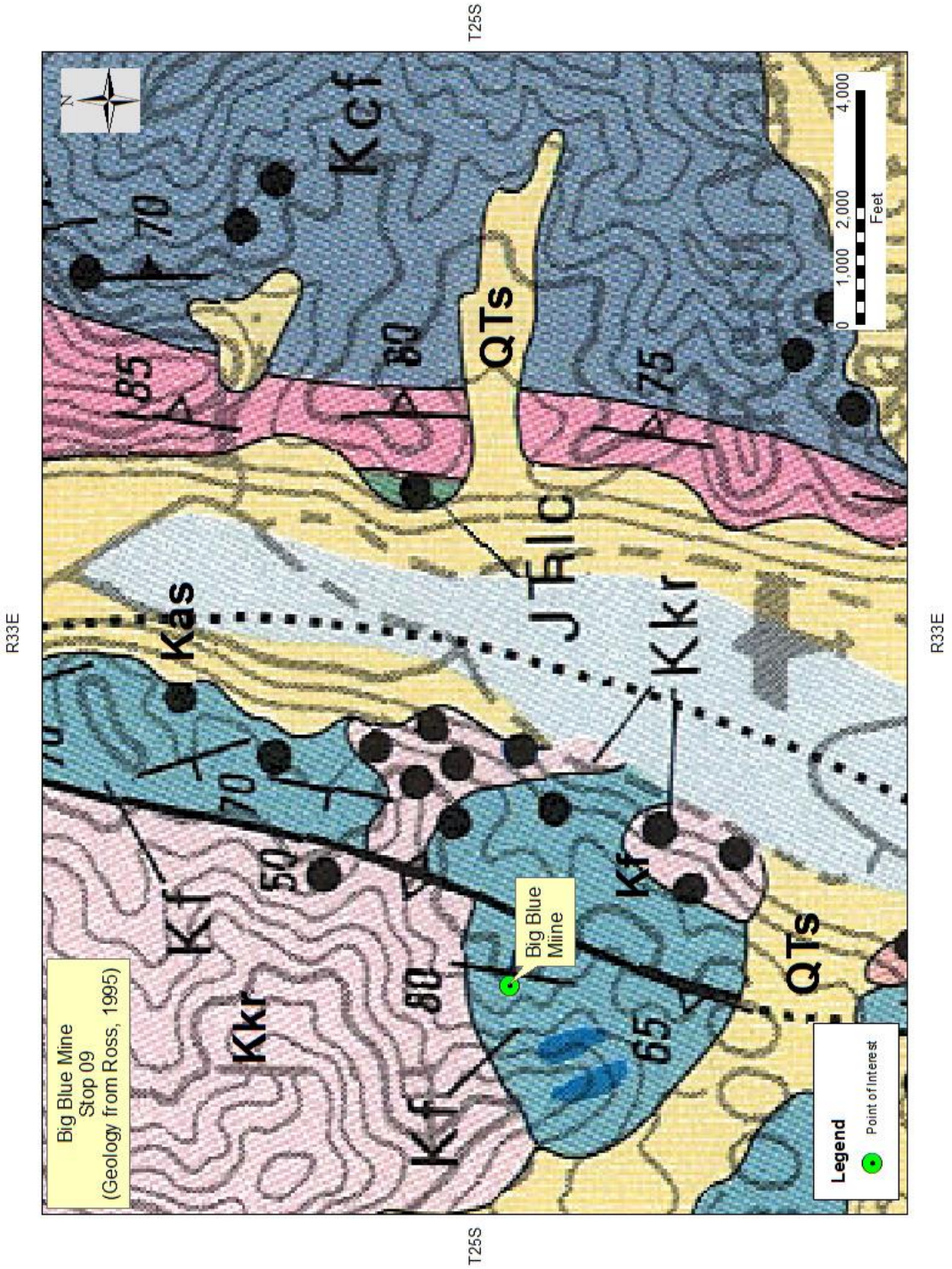



Figure 45. Geologic Map of Stop 9: Big Blue Mine. Geology adapted from Ross, 1995.

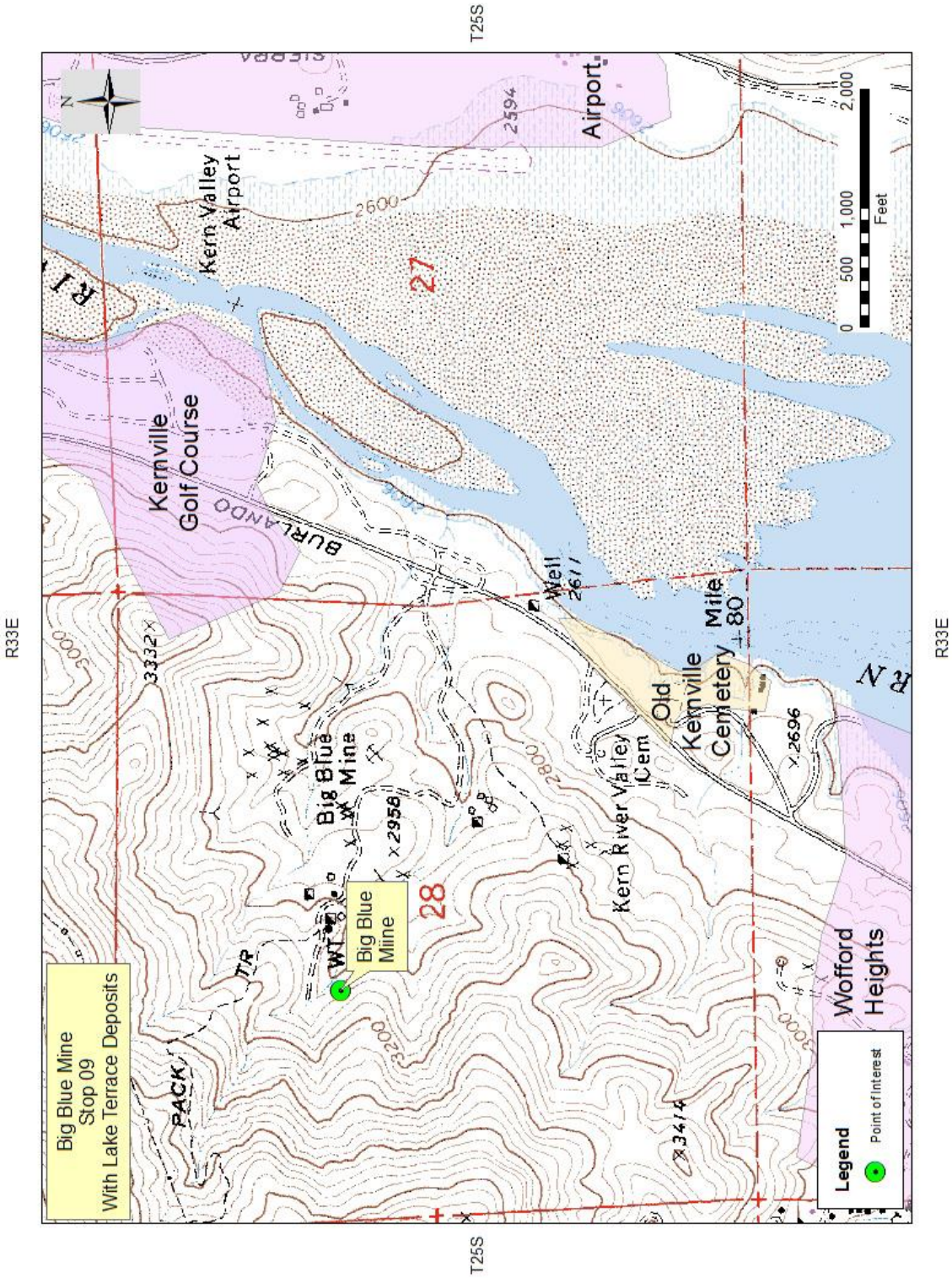



Figure 46. Topographic map of the Big Blue mine and surrounding area sowing locations of Lake Ferdinand terraces.

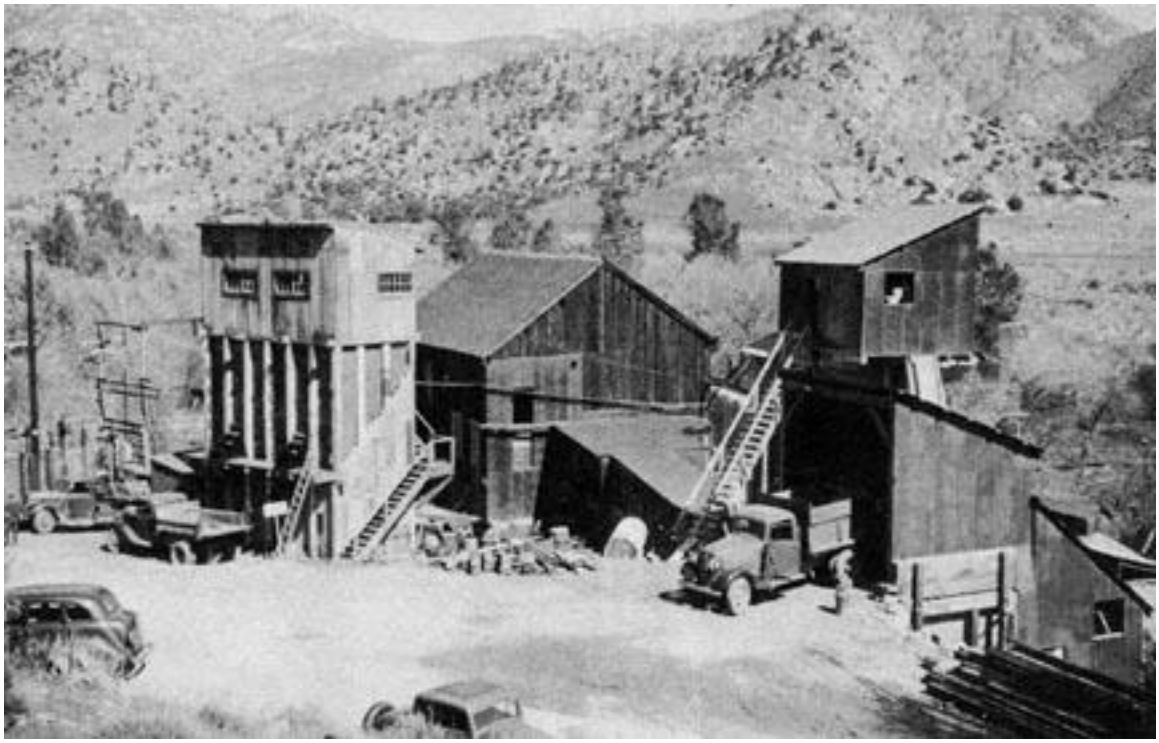


Figure 47. Big Blue Mine. Photo from http://www.digmyguitar.net/ebay/kernville-big-blue-buildings.jpg accessed Oct. 31, 2017

RETURN EAST TO HIGHWAY 178/155 INTERSECTION.

## PART 3: LAKE ISABELLA TO KELSO VALLEY

### AREA MAP 07

Reset Odometer

0.0 Highway 155 (Nugget Road) intersection and Lake Isabella Blvd. The Dam Corner Restaurant is to the northwest.

Go north on Highway 178 toward South Lake.

0.9 Lake Isabella Dam on the left (northwest). The dam is being retrofitted because of leaking and for earthquake abatement. The original town of Isabella is inundated by the lake. On the right (east) is Cook Peak which is composed of The Kern River Granodiorite of Cretaceous age. It has abundant potassium

feldspar crystals.

1.0 The Kern River Fault follows the peninsula we saw at Engineer's Point. The Kern River Fault splits into two branches in this area. The northern branch is called the "Big Blue" and goes toward Wofford Heights. The other branch follows the Kern River to the east.

1.5 Boat ramp on the left.

1.9 Old Isabella Road Campground.

2.1 Layered rocks of the Kernville Series on the left (north) side of the lake with Granite of Kern River at the western end of the peninsula. These rocks are metamorphic roof pendants: the remnants of what existed here before the plutonic rocks intruded. From west to east these are

| | | |
|---|---|---|
| Rocky Point: | Krv | Granite of Kern River |
| | Kfv | Fairview Quartzite |
| | JTrlc | Long Canyon Formation metasediments |
| Robertson Cove: | Kcf | Quartz Diorite of Cyrus Flat |
| | Kri | Granodiorite of Rabbit Island |


Figure 48. Granite of Kern River (Kkr), Metavolcanic of French Gulch (Mzfg), Metasedimentary Rocks of Long Canyon (JTrlc), Quartz Diorite of Cyrus Flat (Kcf),Granodiorite of Rabbit Island (Kri) on the north side of Lake Isabella

3.2 Flat-topped mountain at 11:00 is an erosional surface. This was once a flat plain

that has now been uplifted and eroded. These were called “Mathus Surfaces” after the geologist who first described them. The area is called the Kern Plateau.

## AREA MAP 09

3.7 Road cut in slate and schist of the French Gulch Formation Metavolcanics. These represent old ash layers.

4.3 Paradise Cove Lodge and Campground. Metavolcanic rocks of the French Gulch Formation are west of the cove and metasedimentary rocks of the Long Canyon Formation are east of the cove.

5.2 Kissack Cove. Rocks here are metamorphic rocks of the Long Canyon Formation.

## PIUTE MOUNTAIN MINING DISTRICT

### INCLUDING THE CLARAVILLE (MT. SINAI, TICKNOR BASIN, EAST PIUTE MOUNTAINS), GREEN MOUNTAIN, PIONEER, SAGELAND, VALLEY VIEW, AND VAUGHN MINING AREAS

To the south is the Piute Mountain district, an area of about 35 square miles, contains about 40 mines and prospects. The district is in the crestal part of the Piute Mountains and centers about the townsite of Claraville, about 14 miles southeast of Bodfish. Gold and tungsten have been the principal mineral products; antimony was produced from one deposit; and large bodies of white to gray carbonate rock have been prospected.

The most productive mines in the district have been the Bright Star, which was discovered about 1870, and yielded gold valued at about $600,000 (1916 value), and the Gwynne, which yielded about $770,000 (1949 value) in gold. Each of the two has yielded several times more gold than the combined total of the other gold mines in the district. The principal periods of gold mining were 1870 to 1900, and the 1930’s to the 1940’s. An undetermined but small tonnage of tungsten had been produced—probably from three mines since 1950, and antimony valued at $13,000 was mined from the Jenette-Grant mine in 1918.

Many of the carbonate bodies within the metamorphic rocks of the Piute Mountains

located 10 to 15 miles south and southeast of Lake Isabella are mixed dolomite, dolomitic limestone, and limestone, and as such, are unsuitable as a source of limestone for portland cement and other industrial use requiring material of a specific chemical composition.

5.5 The house is on a patented mining claim. The vein runs through the road cut.

6.8 Mountain Mesa. A Limestone roof pendent can be seen from this point. To the north are Kernville Series Rocks west of Hanning Flat.

The Goat Ranch Fault is located about one mile (1.6 kilometers) to the east of Cook Peak Fault. The fault trends north—south, crossing under the lake to join the Kern Canyon Fault north of Kernville.

8.7 Road cuts in marble. This unnamed marble ledge is part of the Long Canyon Formation. The ledge enters the lake from the south shore, Lime Point, and is continued on the north shore, Lime Dyke. At the east side of this peninsula is the Granodiorite of Lime Point. At various times the limestone has been mined.

At the east side of this peninsula is the Granodiorite of Lime Point.

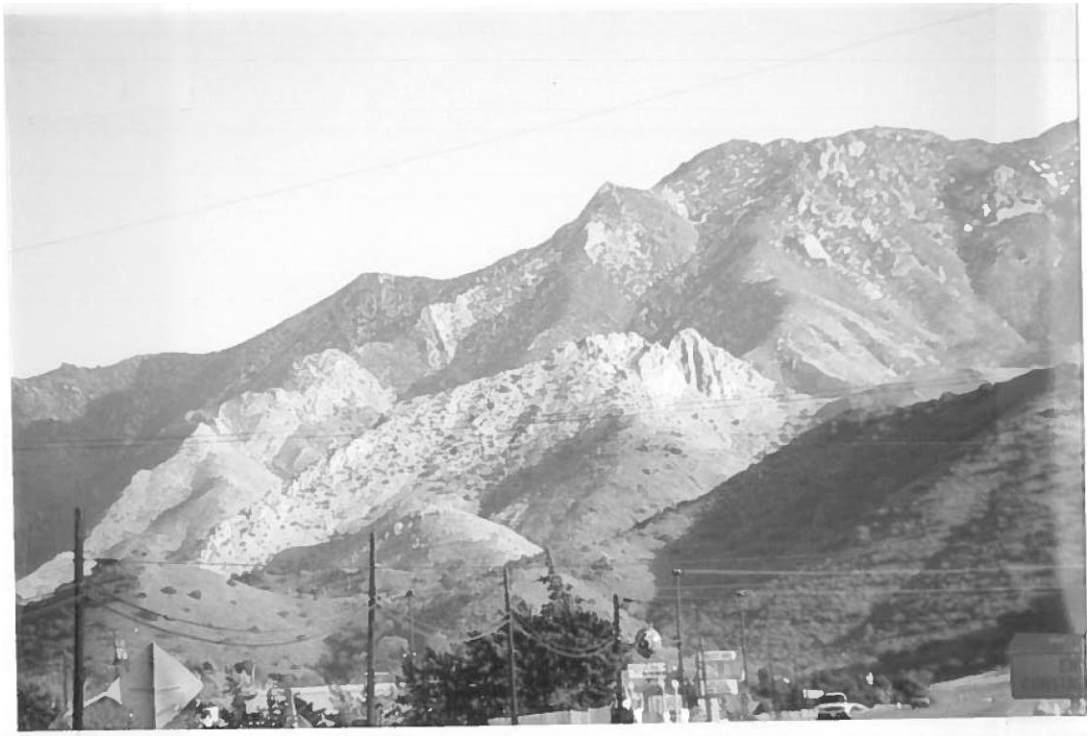
8.8 Former BLM-administered lands originally homesteaded under the Stock Raising Homestead Act (1915) on the left (north). These patents retained all minerals, ditches and canals to the U.S. Government. They were open to mineral entry by anyone under the 1872 Mining Law. The present residential housing development was delayed due to the clouded mineral title. BLM conveyed the minerals to the developer per section 202 of the Federal Land Management and Policy Act (1979) and permitted the developer to secure a loan for this development.

8.4 South Lake Community. Marble mine a right (south).

Note how the more-resistive marble makes a ridge. The surrounding schists and slates erode more easily in the dry climate. Limestone outcrops to the east have pelecypods of Jurassic or Triassic age. Any benthic aquatic mollusk belonging to the class Pelecypoda is characterized by a bilaterally symmetrical bivalve shell, a hatchet

shaped foot, and sheet-like gills. The presence of fossils is very unusual in these metamorphic rocks because of the high temperatures of metamorphism usually destroy the fossil. These are Metamorphic Rocks of Long Canyon units.


Figure 49. Metavolcanjc of French Gulch (Mzfg), Metasedimentary Rocks of Long Canyon (JTrlc), Quartz Diorite of Cyrus Flat (Kcf), Granodiorite of Rabbit Island (Kri) on the north of Mountain Mesa to Hanning Flat



Lime roof pendant in Long Canyon Formation south of Mountain Mesa

Limestone quarry in Long Canyon Formation south of South Lake.

Figure 50. Limestone pendant and quarry.

8.5 Within the valley to the south (right), on the west is the Granodiorite of Rabbit Island, the center is the Granodiorite of Castle Rock, and on the east is the Metasedimentary rocks of Long Canyon. An archeological site of an old Indian Village is between South Lake and Sierra Way.

8.6 Sierra Way at Bella Vista (Community).

9.3 Semi-Layered nature of Isabella Plutonic Complex at 11:00 on the left (north). This layering of the intrusive rocks was explained by Collins (UC Fulerton) as the result of regional hydrothermal differentiation.

## AREA MAP 10

9.7 Wildlife Reserve to left (north). Area is closed to mineral entry.

10.3 Old Indian Village on right (south).

11.4 Vista Grande Road. Rabbit Island Granodiorite to right (south). The Castle Rock Granodiorite lies between the Rabbit Island Granodiorite and the Long Canyon Formation to the west.

11.6 Road to Kernville Airport, north lake loop.

12.7 Kern River Wildlife Preserve.

12.8 Kelso Valley Road. TURN RIGHT and go south 100 feet to the Weldon Millsite.

13.0 Weldon Millsite

## STOP 10: WELDON MILL SITE AND LAKE FERDINAND TERRACES

The Weldon Tungsten mill was located near the river because water was needed to operate it. Tungsten ore was brought here from several mines in the area. The mill was closed in the late 1950's due as tungsten mining ceased due to low prices. The last remaining tungsten mine in the United States, the Pine Creek Mine in Inyo

County, California, closed in 1990. Most of the tungsten ore used in the United States is imported from China.

**Weldon Millsite**

Figure 51. Weldon Tungsten mill in 1993. Photo by Gregg Wilkerson

A rhodocrosite deposit lies over the hill to the southwest of the mill. Rhodocrosite

is a rose-red or pink to gray in color. The ore is a manganese carbonate, isomorphous with calcite and siderite, commonly contains some calcium and iron, and is a minor ore associated with sulfides of copper, silver, and lead, and other manganese minerals. The Granodiorite of Rabbit Island crops out at this location.

This area has a remnant terrace of pluvial Lake Ferdinand clinging to the sides of the hill. It is being mined and will soon disappear. The road is on a lower, younger terrace.

## WELDON TUNGSTEN DISTRICT

The Weldon district is located several miles east of Lake Isabella within the Kelso Valley, about 44 miles northeast of Bakersfield. The district encompasses at least 12 bodies of scheelite that lie within a northwest trending belt approximately 1 mile wide and 8 miles long. Tungsten concentrates have been recovered from at least four mines in the district-the B. and F., Last Chance, Stardust, and Lucky Boy-and others may have had uncredited production. The total output of the district is probably several tens of units of scheelite occurring in garnet—epidote tactite and has been mined since 1941.

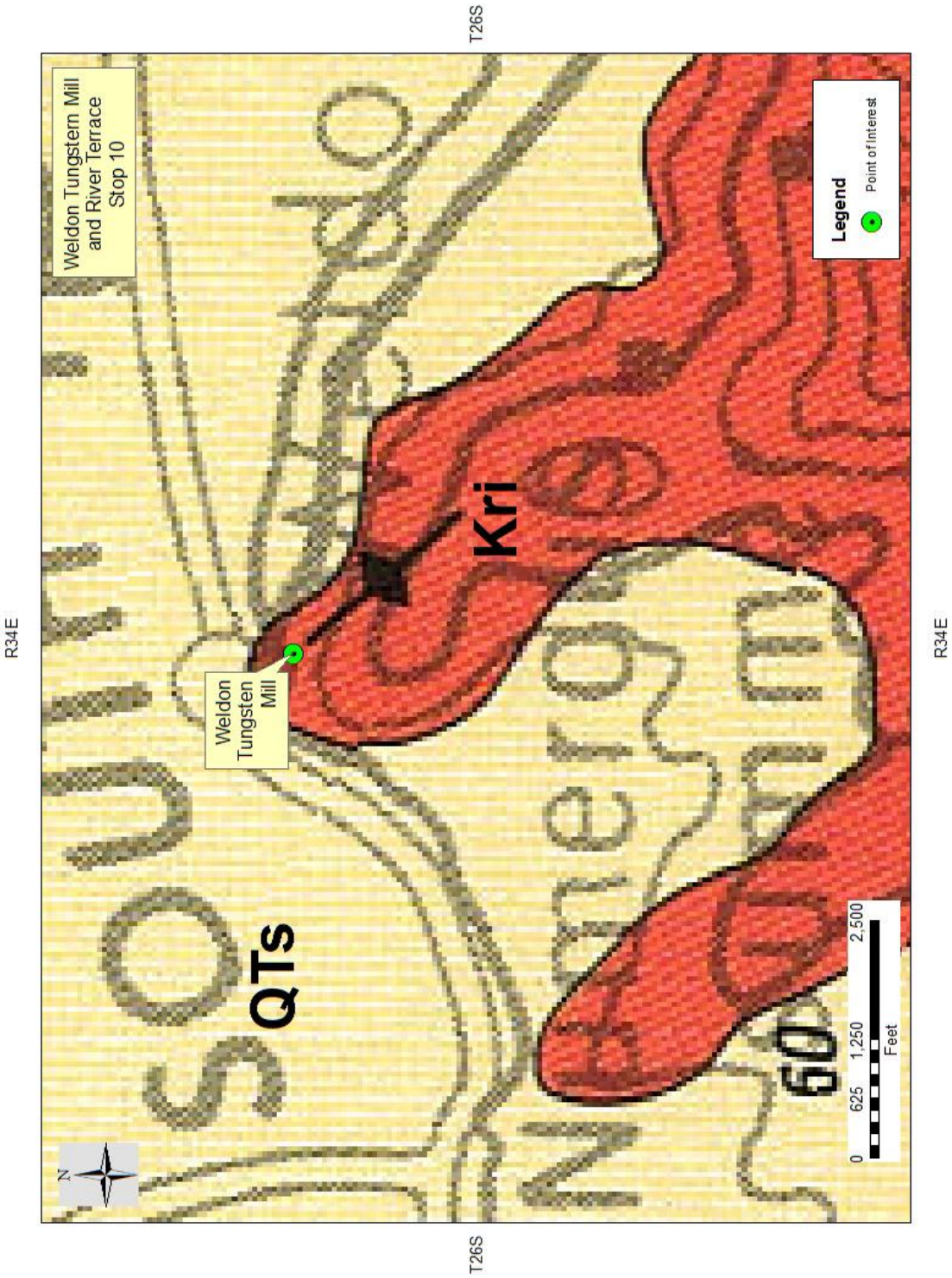



Figure 52. Geologic Map of the Weldon Tungsten Mill. Stop 10. Adapted from Ross, 1995.

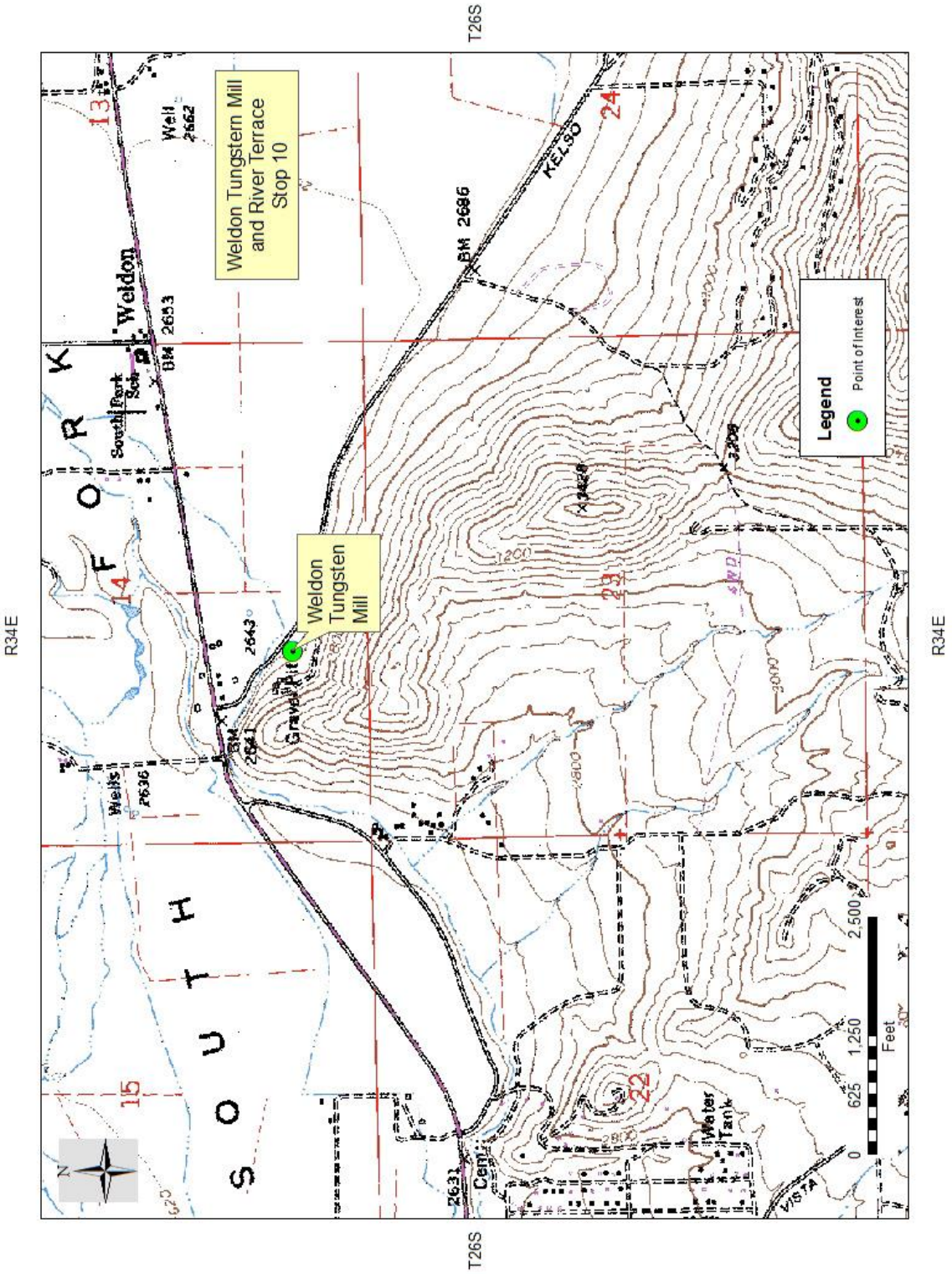



Figure 53. Topographic map for Stop 10.

Figure 54. Lake Ferdenand terrace deposits at Weldon Tungsetn Mill. Photo by Gregg Wilkerson, December 31, 2013.

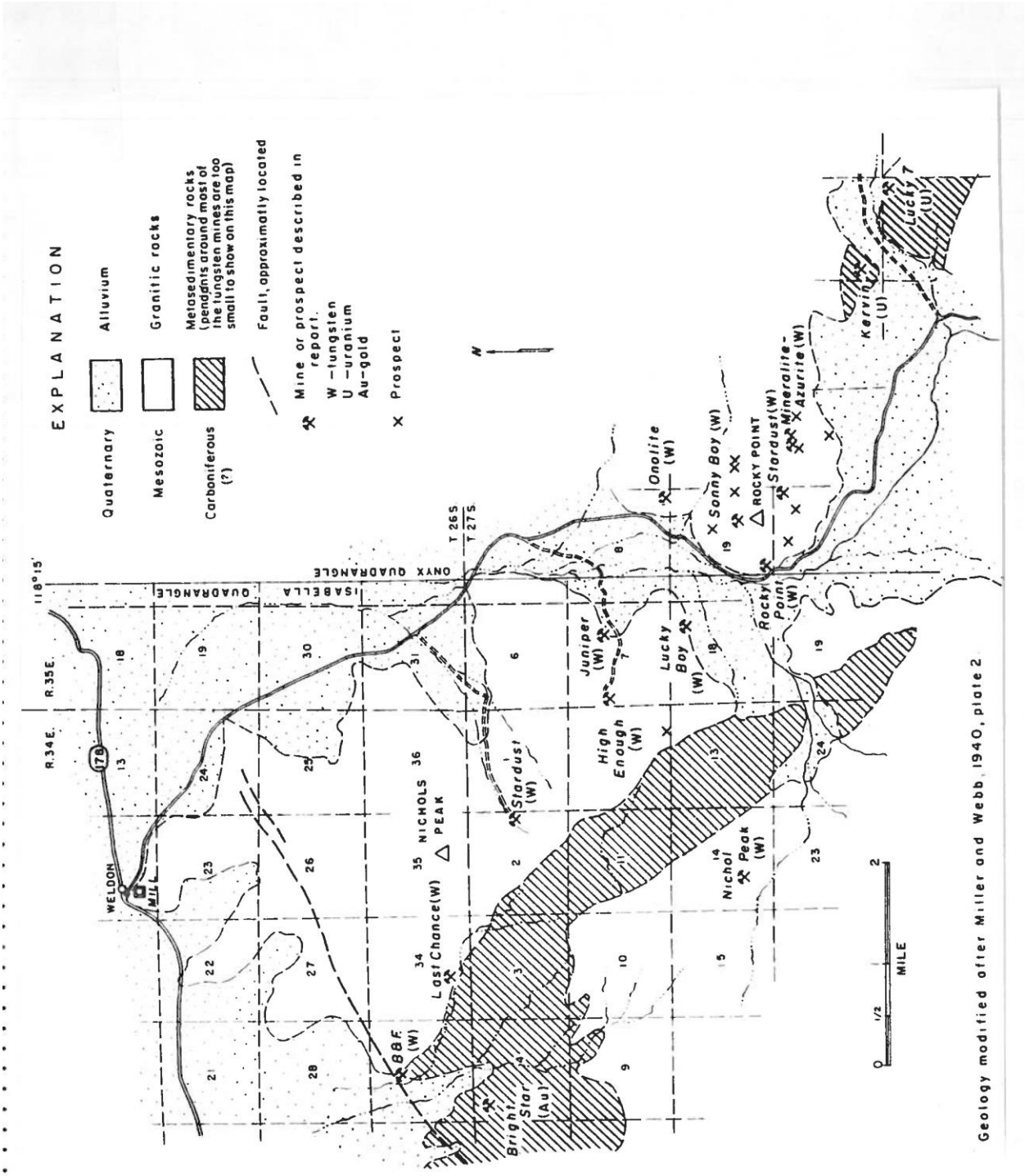
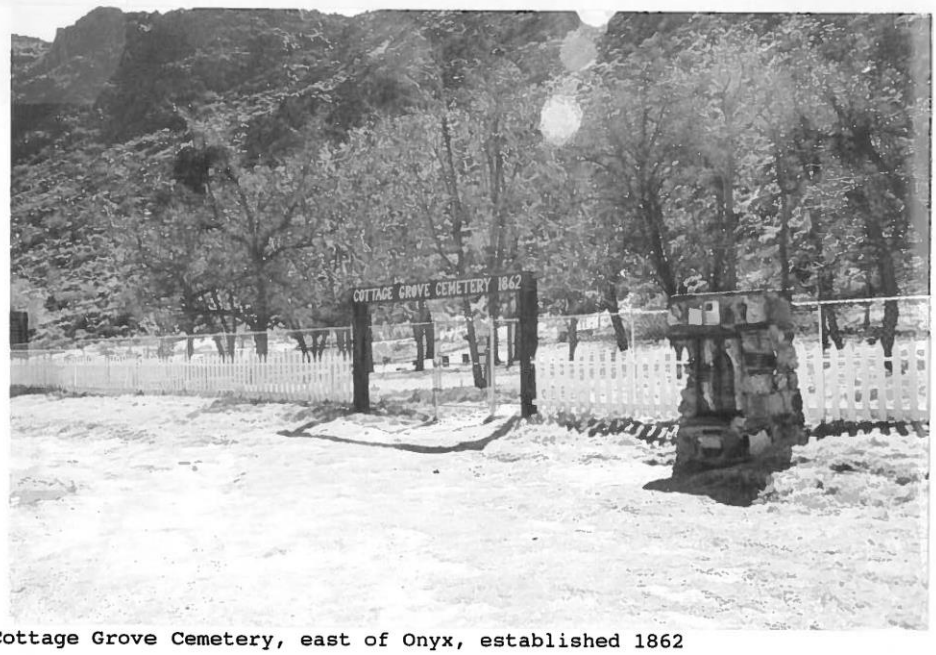



Figure 55. Weldon Tungsten District. From Troxel and Morton, 1968.

Figure 56. Ruins of Weldon Tungsten Mill and Lake Ferdinand terrace deposits. Photo by Gregg Wilkerson, September, 2015.

If you continue east on Highway 178 from this point you will encounter the old Onyx store and the Cottage Grove Cemetery


Onyx Store, established in 1861, Onyx, California




Cottage Grove Cemetery, east of Onyx, established 1862

Figure 57. Onyx Store and Cottonwood Cemetery in 1993.

From the Weldon Mill Site, go southeast on Kelso Valley Road

2.5 Weldon Jr. Highschool on right (east)

## AREA MAP 11

4.8 Drop down from Lake Ferdinand to modern Kelso Creek Wash

5.1 Intesection of Kelso Valley Road and Kelso Creek Road. Turn left and go north on Kelso Creek Road.

5.2 Turn off to Kelso Community Gravel Pit. Take the dirt road right and drive up to the Community Pit

5.3 Kelso Community Pit

## STOP NO. 11: KELSO COMMUNITY PIT


The Kelso Community Pit produces mineral materials, mainly decomposed granite from fluvial in-wash associated with Pleistocene Lake Ferdinand. Here the Kern River once flowed to the south, reversing direction when the Lake Ferdinand natural dam was breeched by the Kern River. Then this lake terrace and others were formed as the lake receded.

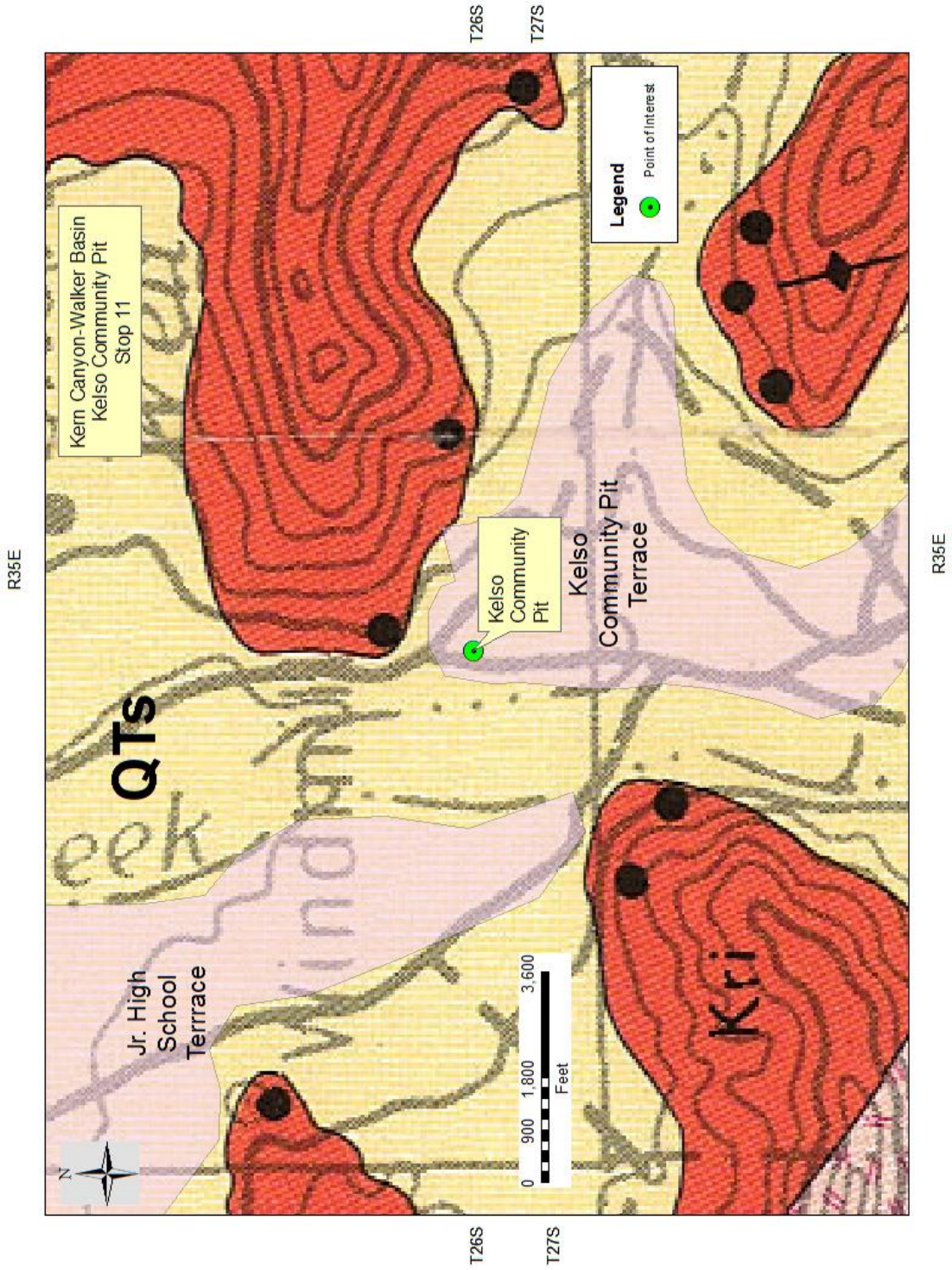



Figure 58. Geologic map of Kelso Community Pit, Stop 11. Geology adapted from Ross, 1995.

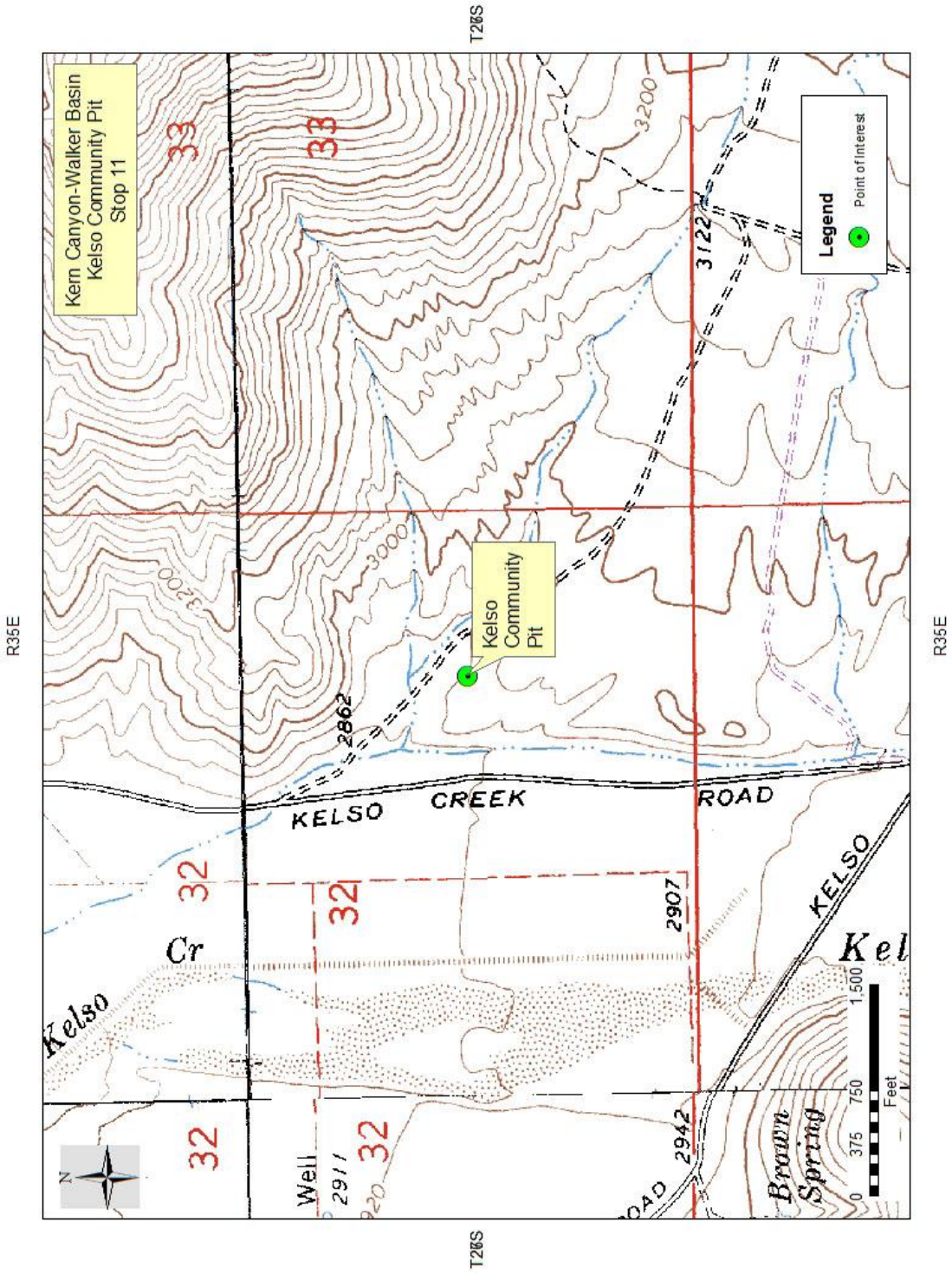



Figure 59. Topographic map of Kelso Community Pit.

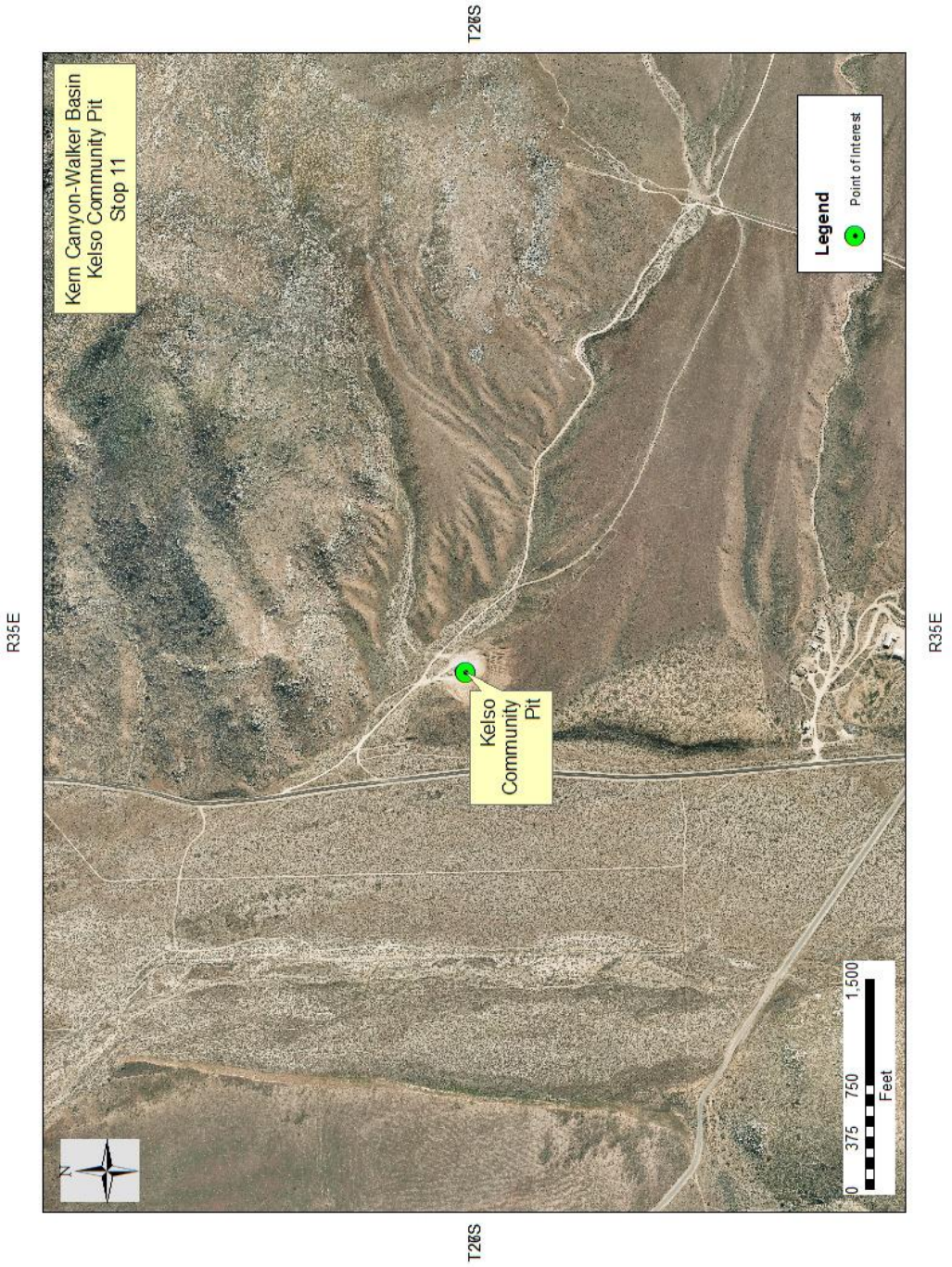



Figure 60. Aerial photo of Kelso Community Pit. From ESRI, 2017.

Return to the Kelso Community Pit Turnoff.

0.0 Kelso Community Pit Road intersection with Kelso Creek Road. Turn right and go north on Kelso Creek Road.

3.5 Turn north (right) at cut-off road that is 0.25 miles east of Highway 178.

3.7 Outcrops of Granodiorite of Rabbit Island

## STOP NO. 12: GRANODIORITE OF RABBIT ISLAND

Walk east over to the outcrops. There you will find the Granodiorite of Rabbit Island with feldspar phenocrysts up to 2 inches long.

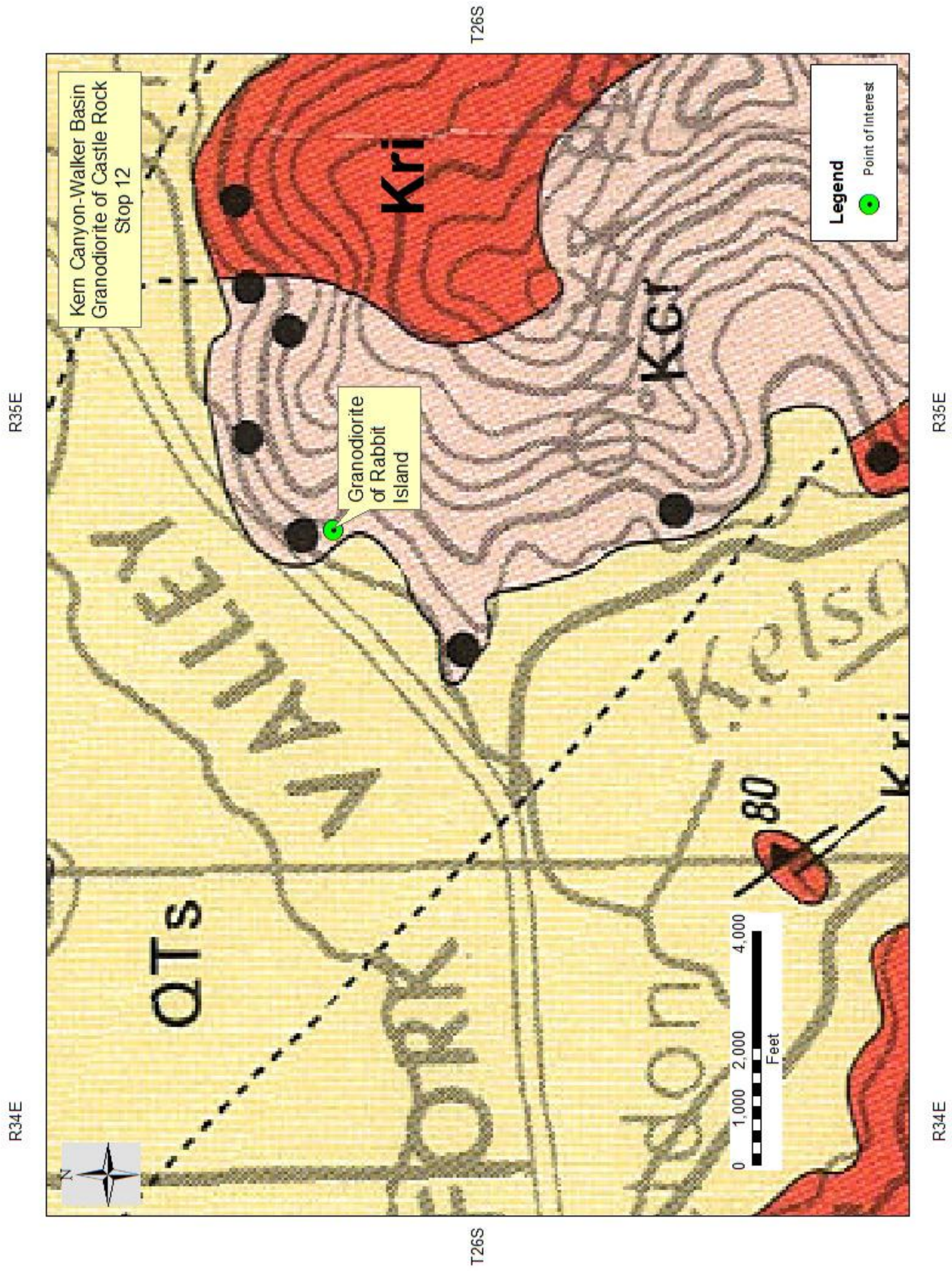



Figure 61. Geologic map of Stop 12. Granodiorite of Rabbit Island.

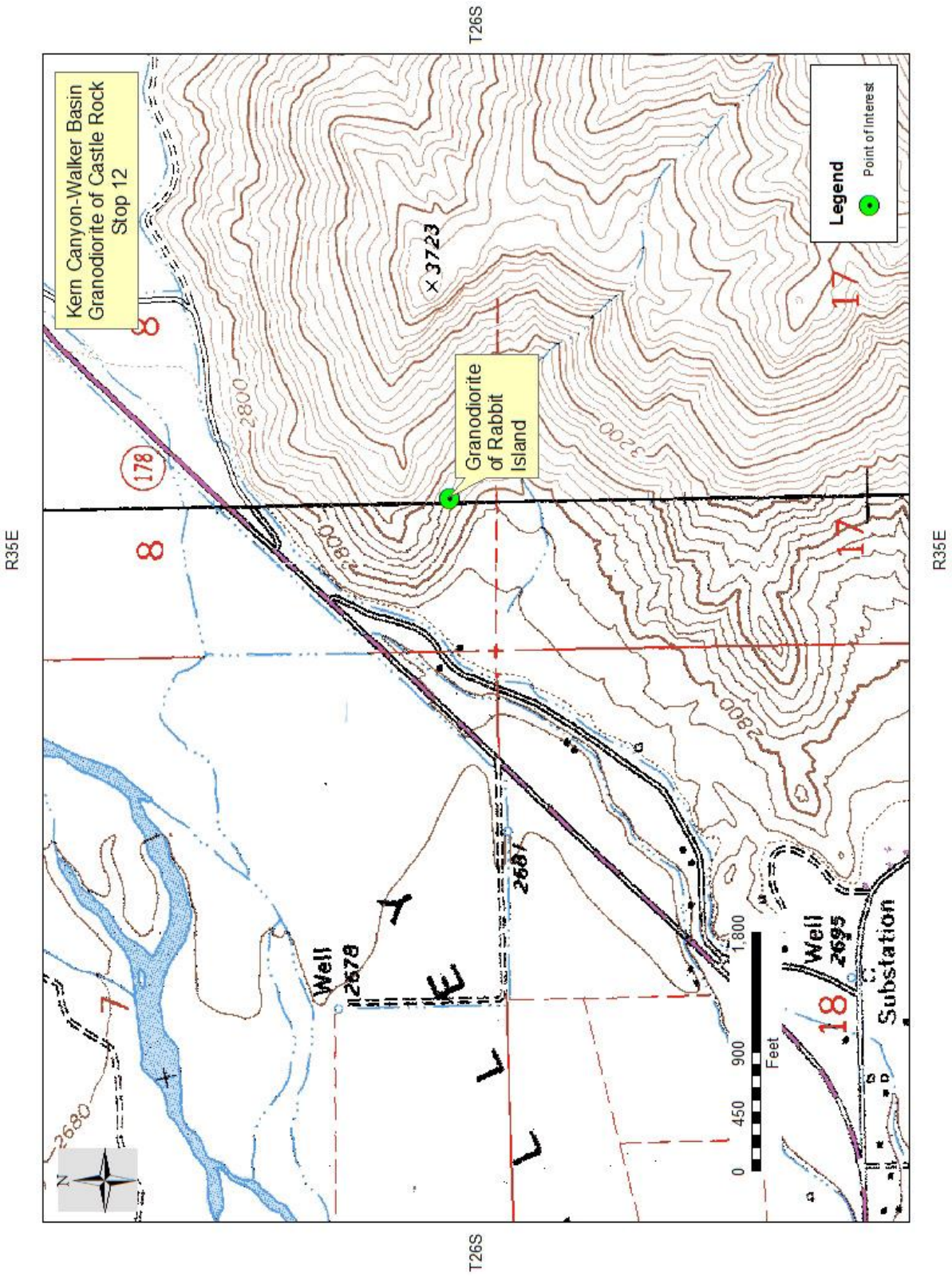



Figure 62. Stop 12: Granodiorite of Rabbit Island

RETURN TO LAKE ISABELLA

# PART 4. LAKE ISABELLA TO LORAINE

## AREA MAP 07

0.0 Isabella “Tank” Park

## AREA MAP 06

0.6 Town of Bodfish. Fairview Quartzite is to the left. Alta Sierra Granodiorite is to the right.

1.0 Passing under the aqueduct, to the right is an exposed gray limestone bed within the Fairview Quartzite.

1.5 The Kern Canyon Fault is 200 yards to the left. 2.0 Crossing the Kern Canyon Fault Zone at this point.

2.2 Lake Isabella is on the right (north).

2.5 Kern Canyon Fault is on the left.

3.0 Crossing the Kern Canyon Fault at the U-Shaped Turn in the road. The fault continues up the valley.

## CLEAR CREEK (HAVILAH) DISTRICT

The Clear Creek or Havilah district is in northeastern Kern County about 26 miles east-northeast of Bakersfield and 5 miles south of Bodfish. The district comprises an area of about 40 square miles which is bounded approximately by Hobo Ridge on the west, Kern River on the north, Walker Basin on the south, and Bald Eagle Peak on the east. The district has yielded principally gold and tungsten, but deposits of placer gold, antimony, uranium, and rare earths also have been found.

The earliest discoveries of gold at Clear Creek were made in 1864 by Claude de la

Borde, George McKay, Benjamin T. Mitchell, and Hugh McKeadney. In 1865 the town of Havilah was established at the center of an elongate north-trending valley which traverses the area, and by the winter of 1865-66 had attracted an estimated 3,000 people.

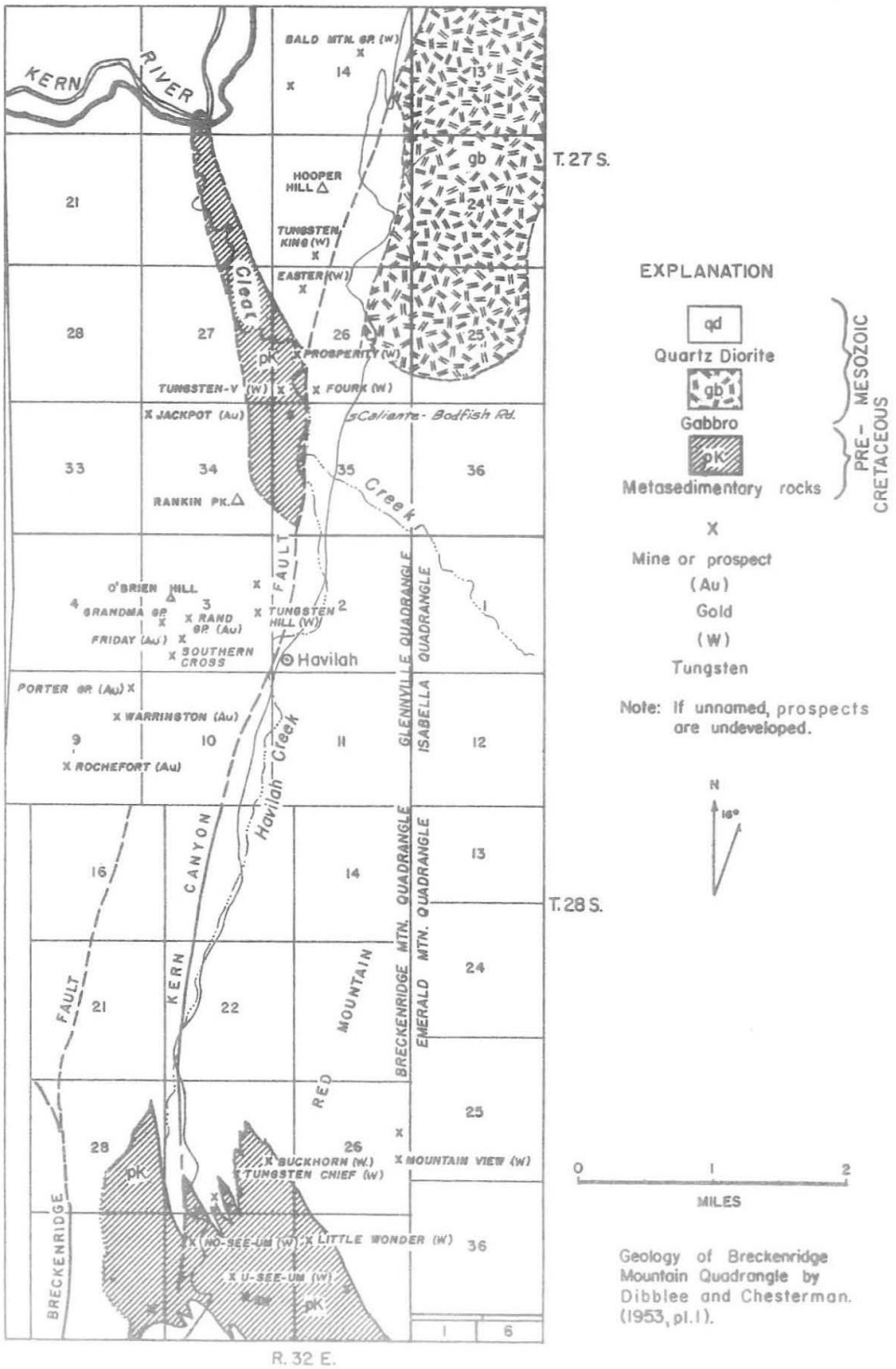



Figure 63. Geology and mines of the Clear Creek and Red Mountain Districts. From Troxel and Morton, 1968, p. 28.

The mineral deposits, almost without exception lie along northeast-trending

structural features. Most of the gold deposits are in a group of veins that strike N. 45°E. and dip steeply to the southeast. Although the veins are discontinuous, the veins form a zone about 1,000 to 2,000 feet wide that extends from the area just north of Flying Dutchman spring to the base of Rankin Peak, a distance of approximately 4 miles. Individual veins range in width from 3 inches to 6 feet, and most can be traced for several hundred feet along the surface. Veins are composed typically of quartz and fault gouge in which are small grains of arsenopyrite, pyrite and free gold. Silver is generally present in small proportions, probably in solid solution with the gold, as no silver minerals have been recognized. Many of the ore shoots are at or near junctions of the principal vein with converging cross fractures, although some of the ore shoots have no apparent structural control.

Tungsten minerals are present in both quartz veins and tactite zones. The tactite bodies typically are lenticular and 1 to 15 feet wide, are irregularly disposed along the margins of roof pendants, or are adjacent to small masses of granitic rock within the metamorphic rocks. In the bodies the tungsten is in disseminated grains as scheelite in a gangue composed principally of quartz, garnet, calcite, and epidote. The tacti te can be recognized easily by its characteristic brown and green color. In the Clear Creek district tactite bodies formed as a replacement of limestone are more common than tactite bodies formed by replacement of other sedimentary rocks.

Three-quarters of a mile northeast of Havilah at the Alice mine antimony is found in scattered patches within a north-trending pegmatite dike.

Radioactivity has been noted in several pegmatite dikes in the district and has been attributed, in at least one occurrence, to the presence of cyrtolite, a uranium-and rare-earth-bearing zircon. No economic concentrations of radioactive minerals have been found in the dikes.

The south part of the Havilah District includes the Red Mountain Tungsten District.

## RED MOUNTAIN TUNGSTEN DISTRICT

The Red Mountain tungsten district is a four-square area several miles south of Havilah and east of the paved road between Havilah and Walker Basin on the south end of Red Mountain. The total value of the tungsten deposits, since discovery in 1918 and mostly from the Tungsten Chief group, has been estimated to be from

$75,000 to $200,000.

Most of the tungsten (scheelite) ore has been mined from tactite bodies. Commonly the bodies are found along contacts between limestone and mica schists of the pre-Cretaceous Kernville series and between limestone and Mesozoic biotite quartz diorite. The tactite bodies range in size from a few feet to several tens of feet. Scheelite-bearing quartz veins along the contact zone between quartz diorite and mica schist also have been mined. Scheelite is mostly found as grains sparsely disseminated through the tactite and very rarely concentrated.East of the Havilah and Red Mountain Tungsten Districts is the Piute Mountain District.
To the east of Havilah, in the Piute Mountains, is the Piute Mountain Mining District described on page 85.

3. 5 To the right (west) is the Bald Mountain (Buckeye, Buena Vista) group of tungsten mines about a quarter of a mile down the dirt road. The scheelite-bearing quartz veins of the district (Tungsten King, Bald Mountain group), although not in contact with the roof pendants, are within a few hundred feet of them. The veins, which are all in the vicinity of Hooper Hill (formerly Bald Mountain). The veins contain disseminated scheelite crystals, and scattered crystals of pyrite.

4.1 Mount Adelaide Granodiorite is in the road cut on the right.

4.4 TURN RIGHT onto the Lathum dirt road to Lathum Tunnel. At the gate there is an over view of Havilah Canyon.

### 4.5 LATHUM TUNNEL PROSPECT

THIS IS PRIVATE PROPERTY. This is an example of a common exploration tunnel. A 600 foot adit driven at a 90 ° angle into a quartz ridge for exploration in 1908. No production was reported.

To the west is a Forest Service Road that goes to Claraville. Take this road up to a flat area to observe the Bodfish Gabbro

## STOP NO. 13: BODISH GABBRO

The Bodfish Gabbro is a complex mafic and ultramafic rock unit in the Tehachapi Mountains south of Lake Isabella. This complex contains outcrops of dunite, peridotite, magnetite and norite. The western part of the Bodfish Gabbro, adjacent to the Breckenridge-Kern River fault, has outcrops of layered basic intrusive (LBI) consisting mainly of magnetite. The LBI portions of the Bodfish Gabbro are in fault contact with younger granitic rocks and older metamorphic rocks. The Bodfish LBI is a rarely exposed remnant of the ancestral roots of the Southern California Batholith (Wilkerson, 2002).

Reconnaissance mapping of the Bodfish Gabbro indicates that it can be subdivided into several separate mapable divisions based on mineralogy, magnetism and texture. The formation is cut by a number of faults that complicate structural reconstruction. A general layered sequence can be observed with dunite at the base, in the northwest. There is a 100 meter thick magnetite zone along the western edge of the Bodfish Gabbro that transitions up-section into lighter colored norite to the east. The Bodfish Gabbro represents a LBI, the lowest parts of a Jurassic or Mesozoic pluton. It has many characteristics that are similar to those of the Bushveld (Hutchinson, 1988) and Stillwater Complexes (Jackson, 1968; Wilkerson, 2002).

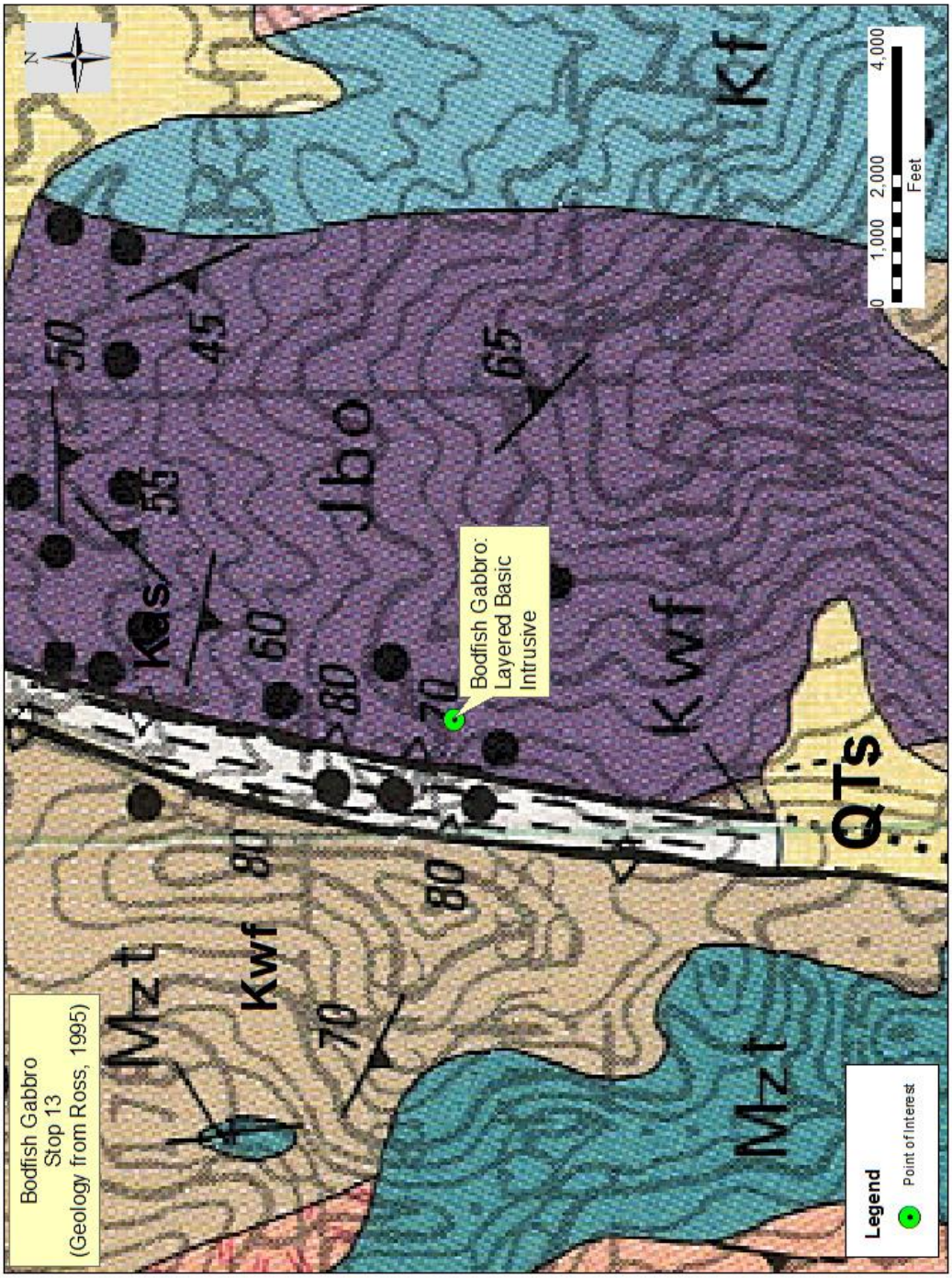



Figure 64. Geologic map of the Bodfish Gabbro and surrounding area. Adapted from Ross, 1968.

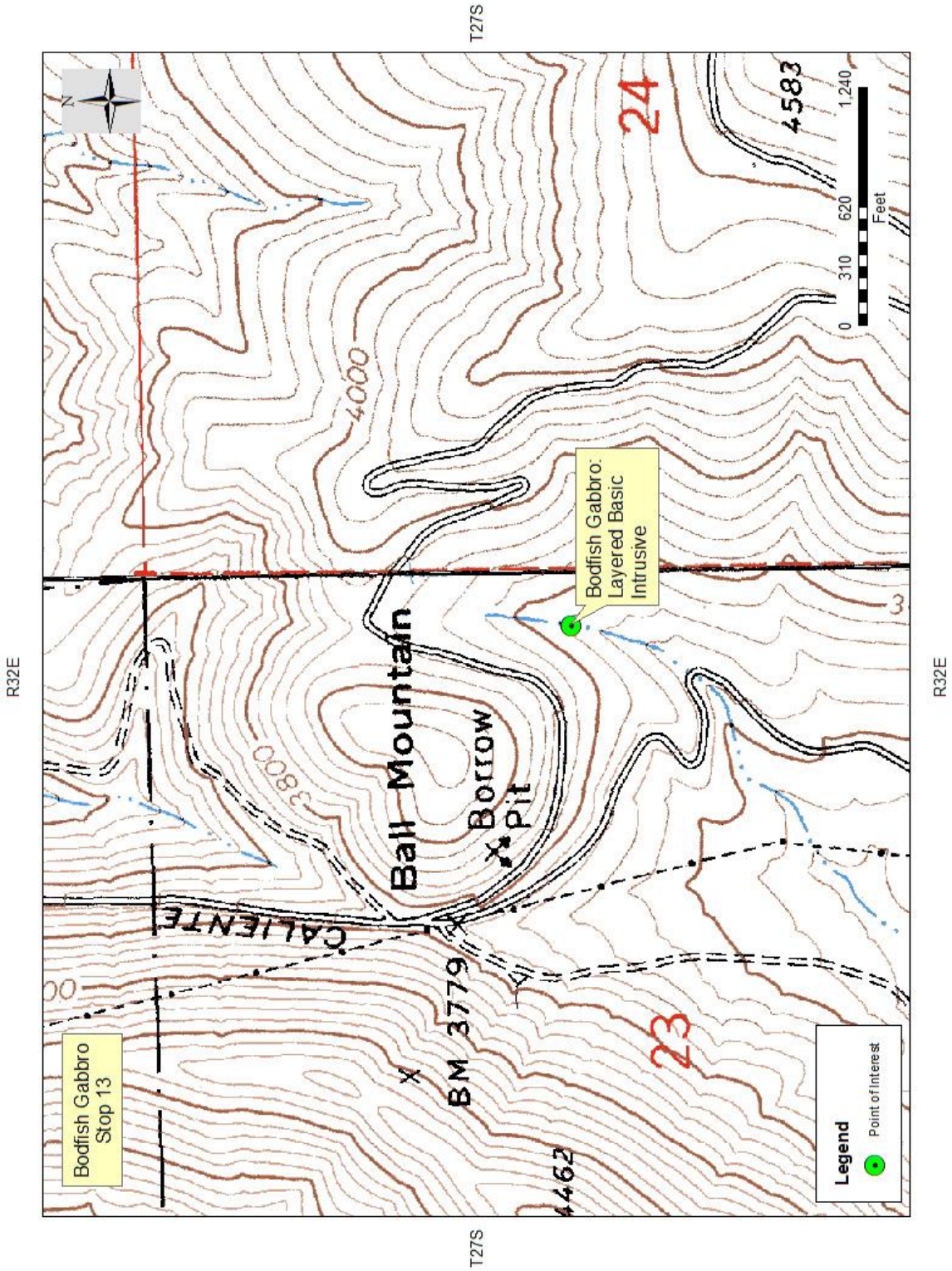



Figure 65. Topographic map of Stop 13: Bodfish Gabbro

0.0 After viewing the Bodfish Gabbro, return to the Bodfish-Havilah Road. Turn left

and go south toward Havilah. Reset Odometer

0.1 The Last Chance prospect, a tungsten mine with anomalous uranium activity, is located l½ mile to right (west). Mt. Adelaide Tonalite is in the road cut.

0.5 A gabbro contact is in the road cut. The Kern Canyon Fault is to right (west). Breckenridge Mountain is directly to the right (west).

0.9 Mt. Adelaide Tonalite is in the road cuts.

1.1 On the right is the Tungsten King Mine and 1 mile to the right (west) is the Jane No. 1 tungsten prospect.

## TUNGSTEN KING OR KING TUNGSTEN MINE

The Tungsten King is located 3 miles north of Havilah on the southeast flank of Hooper Hill. The mine was discovered prior to World War I. The periods of activity have been from 1916 to 1918 and in 1942. Less than 100 tons of ore was mined at 1-2% tungsten. Development consists of a main drift adi t, driven 150 feet northwest, which is intersected by a 35-foot vertical shaft. One ore shoot was stoped in and around the shaft. About 25 feet from the portal a crosscut was driven 25 feet southwest to the west vein where a 75-foot inclined raise, now caved, was driven northeastward to the surface. An undetermined amount of ore was mined from this raise. A second adit was driven north from the collar of the shaft for a undetermined distance.

Between Hooper Hill prospects/mines: and Havilah are the following prospects and mines:

**Easter (Blackbird)** tungsten prospect located 2½ miles north of Havilah and had development limited to a caved drift adit driven for an undetermined distance. No production was reported

**Four K tungsten prospect** located 2 miles north of Havilah in 1941 and reportedly yielded less than 100 tons of ore with an average of 1-3% tungsten. Workings consisted of two 20- and 30-feet long crosscut adits, a 20-foot shaft, and a 25-foot drift adit.

**Tungsten "V" tungsten prospect** located 1/2 miles north of Havilah and was developed by an open cut approximately 100- foot long, 30-foot high, and 30-foot wide. No production was reported.

Tungsten Hill group of 9 claims located three-quarters of a mile north of Havilah and was mined by open cut with one vertical shaft. Production was reported to be $10,000 (1962 value) from 10% tungsten ore.

1.5 The route continues to follow the Kern Canyon Fault.

1. 6 The Mt. Adelaide Tonalite is in the road cut to the left (east).

1.9 The Walker Basin Formation is on right (west) side of Havilah Valley.

2.5 Location of the contact of the Kern Canyon and Breckenridge Faults in the valley.

## AREA MAP 12

3.8 Clear Creek trailhead. The formation to the right is a contact of gabbro and tonalite.

4.4 Havilah Museum

## STOP 14. HAVILAH MUSEUM.

State Historical Marker #100. The town of Havilah was established in 1865 and by the winter of 1866 has a population of 3,000. In 1867, the first county seat was established and held here until 1874, when the center of government was moved to Bakersfield.

Kern Canyon fault is 100 yards to west (right). West of fault is Bear Valley Tonalite. East of the courthouse is Alta Sierra Granodiorite.

Havilah gold prospects are located a few hundred yards west of Havilah on the west side of Clear Creek. They are very old workings that have been cleaned up. The open

workings are a 155-foot drift adit with two crosscut about 30 feet long with another drift on one of the crosscuts. Numerous caved adits and shafts are nearby. Production is unknown.

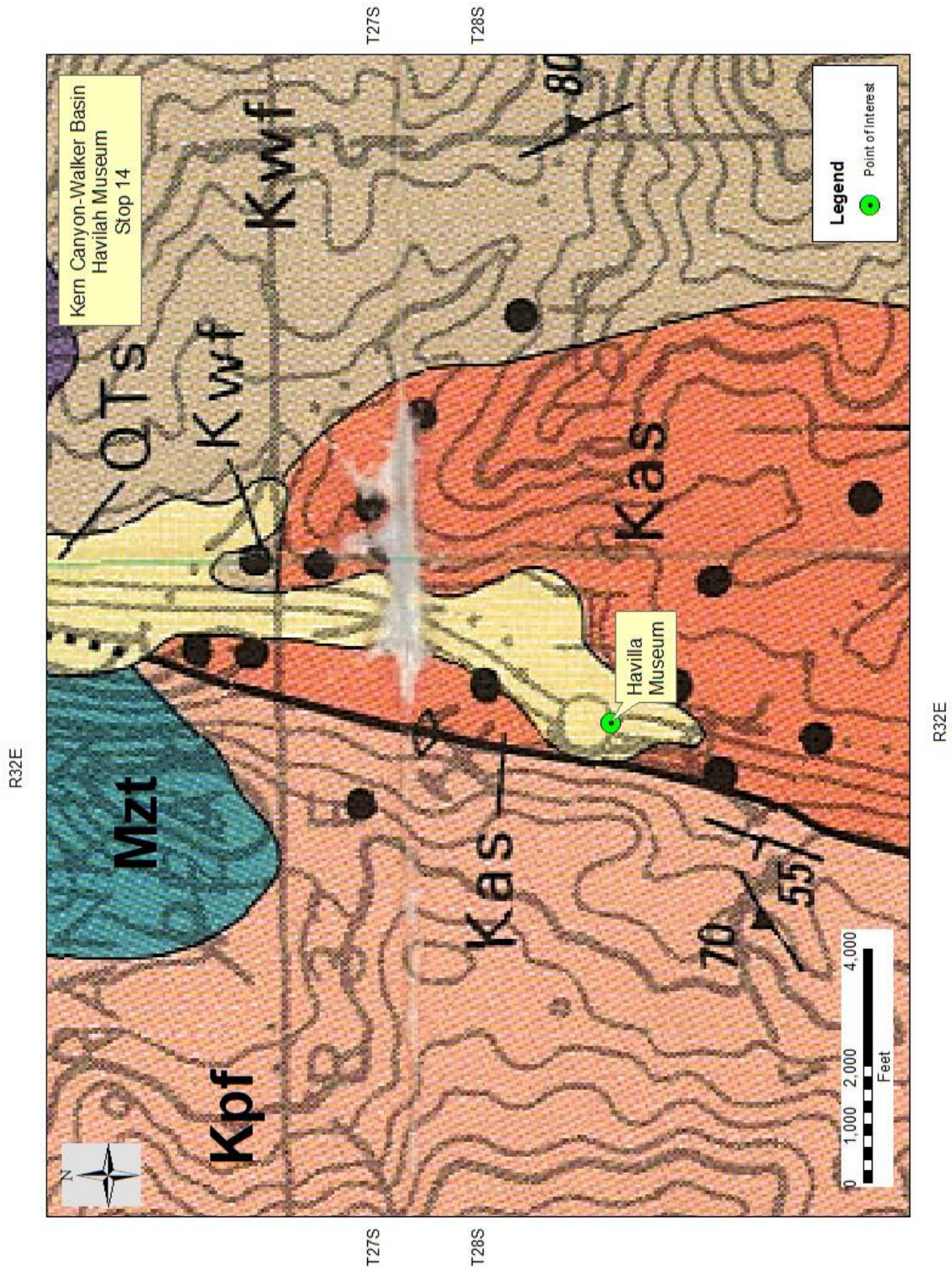



Figure 66. Geology of the Havilah area. Geoogy from Ross, 1995.

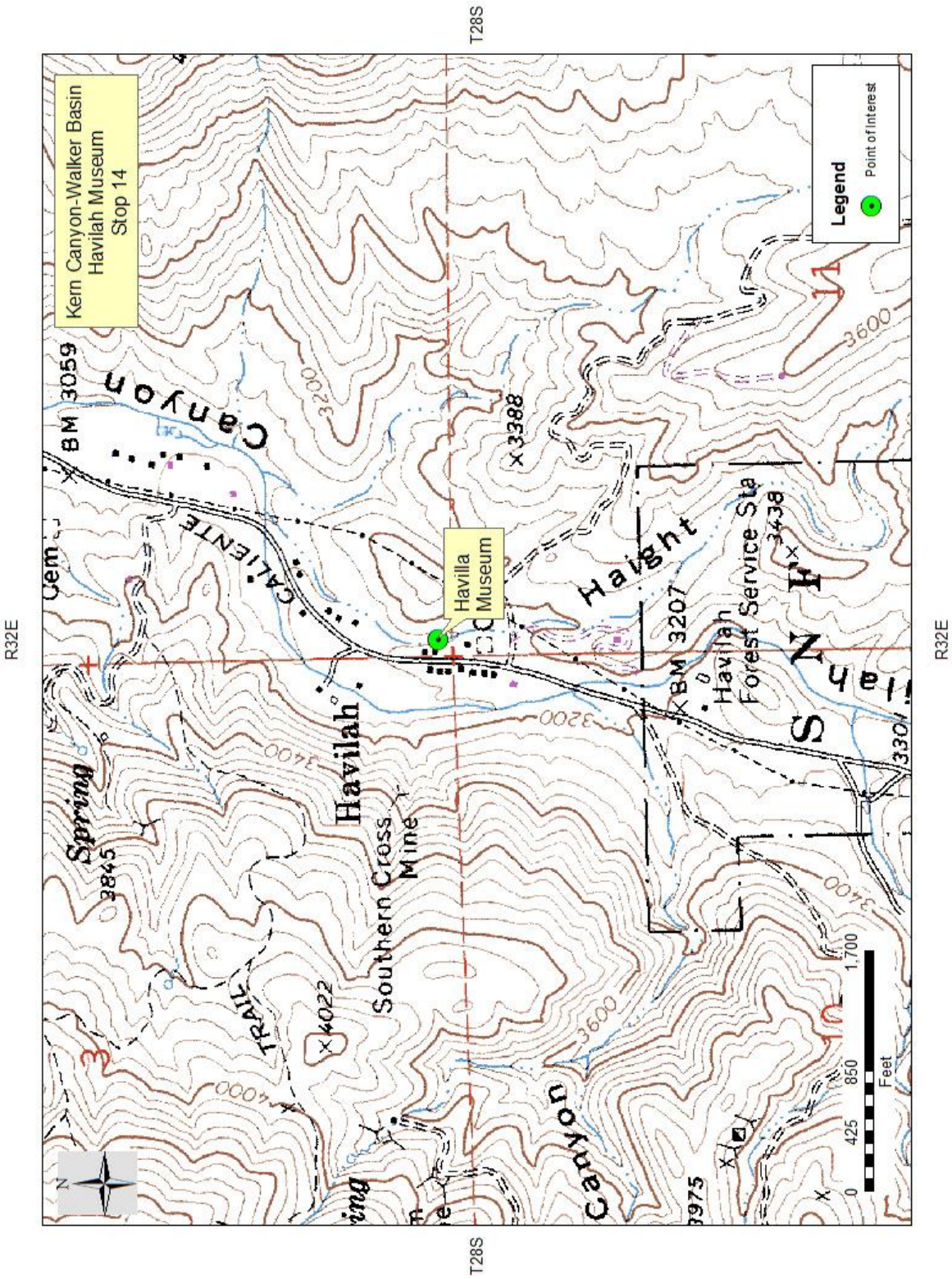



Figure 67. Topographic map of the Havilah area.

0.0 AFTER VISITING THE MUSEUM, RESET ODOMETER TO ZERO.

2.1 Duchman Creek

2. 5 Breckenridge Road. Mt. Adelaide Tonalite is on the left (east) and Bear Valley Tonalite is to right (west).

3.5 Tungsten Chief Mine

## STOP NO. 15. TUNGSTEN CHIEF MINE.

Turn left on dirt road through gate and drive up to end of canyon to the Tungsten Chief Mine.

Tungsten Chief (Wall Street, Ophir-Zuck) Group. (Includes First Landing, Good Hope, Rocky Point Mines). The Tungsten Chief Mine is located and is the principle mine of the Red Mountain Tungsten District.

The Tungsten Chief deposit was discovered about 1918 by A. D. Zuck. A small amount of ore was mined and shipped the same year. Between 1918 and 1939, the mine was idle, but in 1939 a small shipment was made. The mine was most productive during the period 1940 to 1950. The mine's total yield was about 4,300 tons of 0.7-1% tungsten. The tactite zones that were mined were from 4 to 10 feet wide and were several tens of feet long.

The First Landing deposit is the lowest and westernmost deposit of the group and is developed by two 50-foot vertical shafts 500 feet apart and several hundred of feet of horizontal workings driven from adits. Ore was mined from a 100-foot drift adit in tactite zones 500 feet apart. The largest zone was 85 feet long, 6 to 8 feet wide, and averaged 1.75% tungsten.

At the Good Hope mine, 1,000 feet east of the First Landing mine, the tactite zones average about 10 to 40 feet in width and are exposed laterally within a distance of 100 feet. Scheelite crystals generally are about a quarter of an inch in diameter, but a few irregular "spuds" with a maximum diameter of 4 inches, have been extracted. The zones have been mined from a 100-foot drift adit driven southwestward.

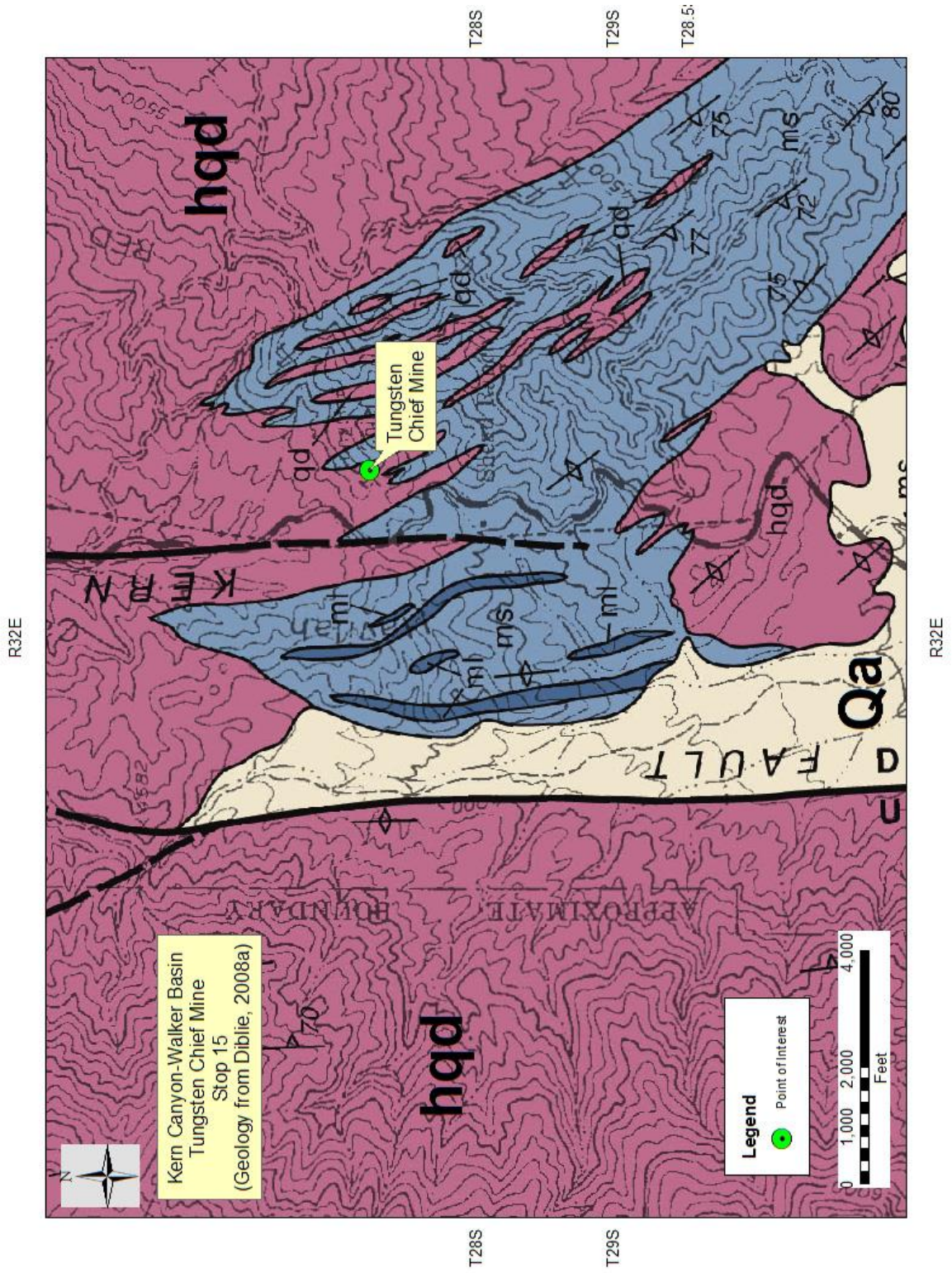



Figure 68. Geologic Map of the Tungsten Chief Mine and surrounding area. Adapted from Ross, 1995.

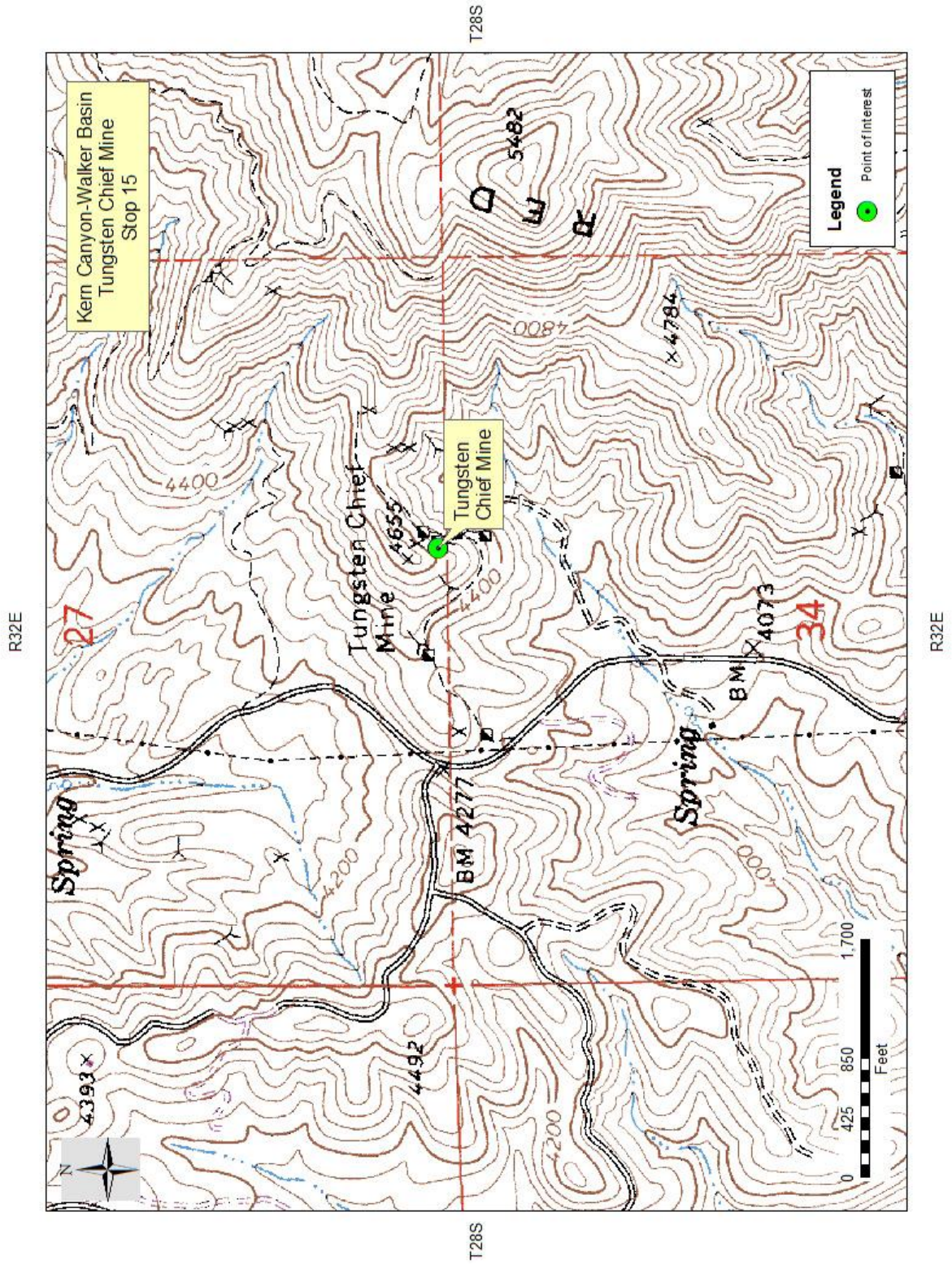



Figure 69. Topographic map of the Tungsten Chief Mine, Stop 15. The Rocky Point mine is located about 1,300 feet northeast of the First Landing mine.

Ore was mined from a in a contact tactite zone 6 to 8 feet wide and 40 feet long. Another ore body, 2,000 feet northeast of this tactite zone, was mined from a mass of quartz with the dimensions of 40 feet wide and 50 feet long. An ore shoot 10 feet wide and 50 feet long was stopped from a an adit driven 50 feet southwest along the axis of the quartz body.

0.0 AFTER STOP RESET ODOMETER TO ZERO. Return to main road. Turn left and go south into Walker Basin.

1.4 Piute Meadows.

1. 8 At 2: 00 on the right is the Bear Mountain Tonalite on Breckenridge Mountain.

In the vicinity of Breckenridge Mountain, 20 miles east of Bakersfield, Dibblee and Chesterman in 1953 discovered and mapped metasedimentary rocks similar to the Kernville series. The metasedimentary rocks consists of schist, quartzite, and crystalline limestone of Carboniferous ( ? ) age and of the Pampa schist of Paleozoic or early Mesozoic age. The limestone crops out prominently at a point on Tweedy Creek 11 miles northeast of Keene and 2 miles south of Breckenridge Mountain quadrangle, and extends north-northeast of about 6 miles across the southeastern part of the quadrangle and beyond the Caliente Creek. The limestone is in north-trending vertical to steeply east-dipping en-echelon lenses as much as 100 feet thick, some of which are at lest 1 mile long The limestone is generally pale gray, fine grained and thick bedded. Beds metamorphosed to a higher degree contain coarsely crystalline white marble. The carbonate-bearing sequence also includes calc-silicate rocks, which crop out mostly north of Walker Basin. Carbonate rocks north of Walker Basin have not been utilized as a source of commercial limestone, but pendants along Tweedy Creek were the source of many thousands of tons of limestone for lime burning during the early 1900’s.

The pendants near Tehachapi have been a source of commercial limestone since the 1880's, first for the lime industry and since 1909 for the portland cement industry. The largest mined pendant is the Monolith Portland Cement Company deposit, 2 miles northeast of Tehachapi. This pendant is crudely triangular in plan, about 3 miles long, and 2 miles wide. The pendant contains quartzite, schist, and a carbonate mass that is more than 3,500 feet long and 2,500 feet wide. In the quarry area the limestone is about 800 feet thick and is underlain by quartzite and schist

more than 500 feet thick.

## AREA MAP 13

3.1 Walker Road/Caliente/Bodfish Road - turn right (east).

3.6 Located at 2:00 (right) is the Bear Valley Tonalite. Located at (straight ahead) is rnetasediments of the Walker Basin formation.

4 .1 Follow the Johns Road/Williams Road straight east on dirt road.

4.9 Veer to the right at the fork in the road.

5.0 At Basin Street and Airport Drive turn right (east).

5.4 Airport Drive and Pinon Way go straight on small dirt road.

5.6 Cross under the power lines and turn left.

## AREA MAP 14

5.7 Go north to first major road. Turn right.

6.0 Follow the road on the other side of creek.

6.4 The tailings on left are of the old Joe Walker Mine.

## 6.5 Joe Walker Mine

### STOP NO. 16: JOE WALKER MINE.

THIS IS PRIVATE PROPERTY. Permission to visit the Joe Walker Mine must be obtained from Ed Layton, 23929 Ridgeline Road, Diamond Bar, CA 91765, (714) 861-3204 or from Jeff Cross (714) 594-2855. Historical information about Walker Basin can be obtained from Francis Wilbur, 41824 Hampton Rd., Caliente CA 93518, (805) 867- 2366.

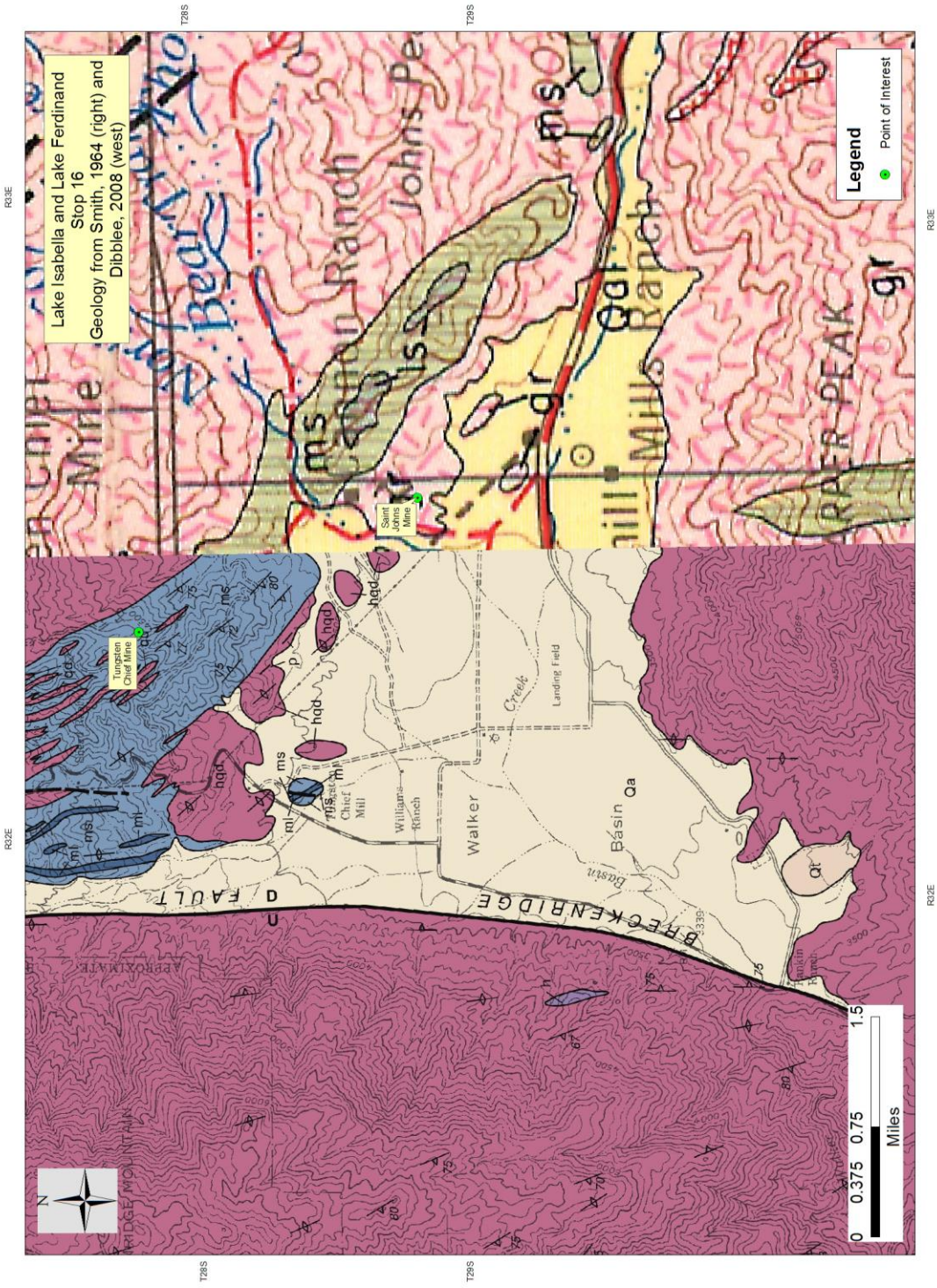



Figure 70. Geologic map of the Joe Walker Mine and surrounding area. Adapted from Dibblee, 2008a (west) and Smith, 1964 (right).

Park at the fence and walk up to the mine.

The Joe Walker Mine is located on the northeast edge of Walker Basin, 7 miles southeast of Havilah.

The deposit on this property was discovered in 1865 by Joe Walker and was operated continuously from 1865 until 1874. The ore was milled on the property in a 20-stamp mill. The mine was shut down in 1874 because of the cost to keep the lower workings free of water. The mine has been idle since then except for a few intermittent and short periods, the most productive and recent of which was in 1951. At that time the Basin Mining Co. recovered more than 900 ounces of gold from an undisclosed tonnage of ore.

Mesozoic quartz diorite underlies the entire mine area. The gold is in a quartz vein 4 to 20 feet wide. The ore consisted mostly of quartz containing auriferous pyrite and arsenopyrite and traces of chalcopyrite. The mill heads contained an average of 1. 2 ounces of gold per ton and the gold-silver recovered was valued at $500,000 to $600,000 (1962).

The mine was developed by a 250-foot inclined shaft (No.1) and a 350-foot inclined shaft (No.2) 260 feet to the southwest. On the 250-foot level, drifts were driven 30 feet southwest of No. 2 shaft, 260 feet northeast to No. 1 shaft and 320 feet beyond the shaft. In 1888, a mining report indicated that the ore was stopped to the surface from 630 feet of drifts on the 250 level, but an unpublished report by R.J. Sampson in 1949 indicated that ore was stopped for a distance of 210 feet southwest of No. 1 shaft and an undetermined distance about 100 feet southwest from No.2 shaft and about 320 feet to the northeast. During 1958, water from the mine was being used to irrigate nearby land in Walker Basin.

TURN AROUND AND FOLLOW THE DIRT ROAD.

7.3 At the intersection of 2 wells and graded roads, a little sign says "Cielo Azul Ranch" to the right. Turn left, and head east.

7.5 At the powerlines, a limestone roof pendent is present in the Walker Formation.

8 . 1 Junction of the Walker Basin\Pamela Streets.

RESET ODOMETER TO ZERO.

0.0 Follow the Walker Basin Road to the left (east).

1.3 Cowboy Memorial and Library located in Walker Basin.

The following information about the Cowboy Memorial and Library is taken from http://astarmedia.com/cowboymemorial.html (accessed Oct. 31, 2017).

*"Fittingly enough we next found ourselves at the Cowboy Memorial in Walker Basin. Which is run by a fellow none of us will ever forget a Paul De Fonville? Let me tell you, Mr. Fonville takes the subject of Cowboy history very seriously!! He is the real deal and he is going to tell you and show you all about the harsh lives they endured. Its best I believe to not stop by unless you have the time, because has I said. Once you're in his place Paul's got ya, and your going to stop sit down and listen - Hear That Partner!! It was quite the experience and most got a real kick out of it. We had lunch there and the sandwiches were quite good. Next we were all brought into Paul's little trailer for a film presentation on Cowboy life and Paul's efforts to preserve the history of how the Cowboy's finalized America. The SoCal Chapter shatters yet another record, as Paul told us that was the most people ever in his trailer at one time. First we have the most motorcycles ever on an AMCA run at Borrego and now this, the records just keep falling - stick with us kids! Paul has multiple trailers full of Cowboy memorabilia and is an authority on it all, he and his wife Virginia have dedicated their lives to keeping that memory alive. In today's world I am afraid they have no easy task ahead of them. We would probably still be there, as Paul was going to show us every branding iron he had - some 2000 of them. When we decided we had better run for it, or we might never finish our ride. So just that quick we were back in the saddle, we pulled away as Mr. Paul De Fonville was telling us that we were leaving as a ship without a rudder. But alas we had to keep moving, we found the Memorial interesting and Paul unforgettable and it's all become part of another fond memory of our club get togethers.*
*As stated by Paul de Fonville, former cowboy and champion rodeo performer (founder and now president of the Memorial): "In a hundred years it may be the only thing left to show people what cowboy life was really like, and who really*

*built the West as we know it today."*

*Paul de Fonville rides the range at the Cowboy Memorial*

*MAGNIFICENT OBSESSION.*

*The Museum is the brain child, dream and the magnificent obsession of Paul de Fonville and his wife Virginia. Paul experienced the cowboy's life first hand, being brought up on a working ranch. In his youth he was a rodeo rider, an early participant in what is now the "PRCA" (Professional Rodeo Cowboys' Association). He was a "calf roper". Paul is Gold Card Holder (#480) and among the "Turtles", the Founders of the Rodeo World. Later, he acted in many western movies. He was "Marshal of the Working Western" in the 1980 Pasadena Rose Parade, and also rode in the 1978 and 1979 Rose Parades.. Paul has since received recognition from both Presidents Reagan and Bush for his many achievements related to Cowboy life.*

*Paul believes that the modern world is fast exterminating the history of a group of brave and strong men who fostered the development of cattle ranches"*

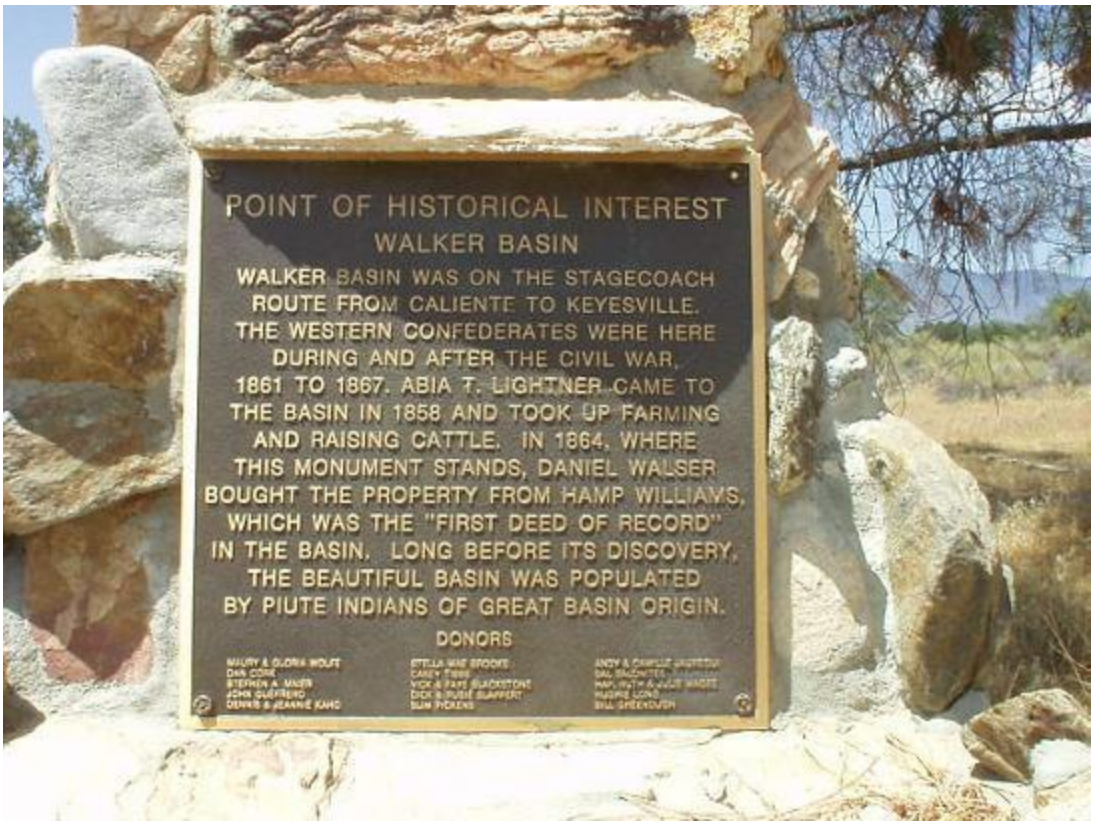


Figure 71. Cowboy Memorial and Library Plaque.

1.6 Driving through Bear Valley Tonalite.

4.6 Pegmatite dikes are present in the road cut.

## AREA MAP 15

5.1 Piute Mountain Road/Caliente Creek Road Junction. This is a contact between the Bear Valley Tonalite and the Mt. Adelaide Tonolite. This area is the Loraine Mining District.

## LORAINE (AGUA CALIENTE, AMALIE, PARIS) DISTRICT

The Loraine District is centered 12 miles north of Tehachapi in the extreme southern end of the Sierra Nevada. The district embraces approximately 60 square miles and is bisected by the upper reaches of Caliente Creek in terrain of moderate to sharp relief. Most of the mines in the district are within a triangular area with apexes at Harpers Peak on the northwest, Eagle Peak on the southwest,

and Stevenson Peak on the east.
Silver and gold valued at more than $600,000 has been yielded by the district since mining began in the 1890' s. The tungsten, antimony, lead, zinc, and copper output has been valued at approximately $150,000. In 1959, a deposit of barite was developed.

The quartz diorite is medium gray, equigranular, medium grained, and, near contacts with roof pendants, is poorly to moderately foliated. The roof pendants are composed of layers of mica schist, quartzite, hornfels, and limestone. The largest roof pendant is a nearly continuous body, which in the Loraine district is 1 to 1 miles wide and extends laterally several tens of miles from Tehachapi Creek on the south to Lake Isabella on the north. In the Loraine district the pendant trends north-northeast between Eagle Peak on the south to the old townsite of Piute.

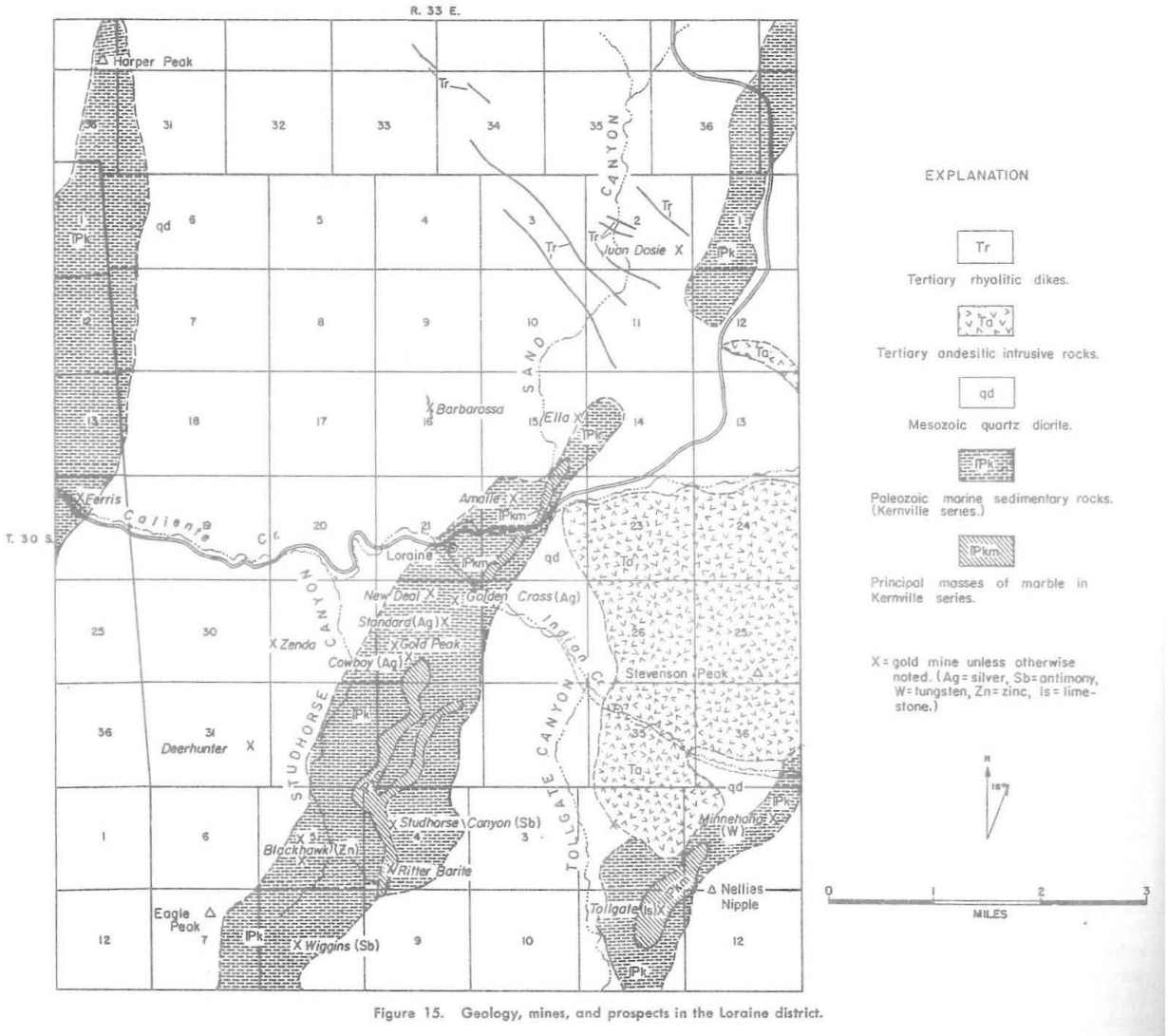



Figure 15. Geology, mines, and prospects in the Loraine district.

Figure 72. Geology and mines of the Loraine District. From Troxel and Morton, 1969, p. 40.

Numerous Tertiary rhyolite porphyry dikes have intruded the rock throughout the district. The dikes range in width from a few feet to many tens of feet and are as much feet long. Most of the dikes crop out as resistant ridge-forming masses that weather to pale buff-yellow color, which contrasts with the predominantly reddish-brown color of the metasedimentary rocks and the knobby rounded outcrops of the granitic rock.

Silver and gold are present in quartz veins commonly within or along the walls of the rhyolite dikes. This relationship suggests that the mineralizing solutions may have been a late phase of the intrusion of the dikes. Re-mineral shearing, faulting

and sheeting provided channel-ways for emplacement of the veins. The veins also commonly extend from the rhyolite into schist or diorite , or lie wholly within them, as at the Ella and Atlas mines.

At the Barbarossa mine, a quartz vein strikes diagonally across a rhyolite porphyry dike to the edge of the dike, follows the contact for a few tens of feet, then swings into the quartz diorite where the vein splits or "horsetails" into minor fractures within a few feet. No known mineralization is associated with the dacite or andesite dikes.

The veins consist principally of white to blue-gray quartz containing pyrite, cerargurite, bromyrite, argentite, and free and proustite also have been noted. Hydrous iron oxides and melanterite are common in oxidized zones near the surface. At the Minnehaha mine large crystals of scheelite associated with free gold are in a vein in schist and limestone.

Zinc, lead, and copper have been mined at one locality in the district, the Blackhawk mine. Aurichalcocite, sphalerite, grossularite, hemimorphite, galena, cerussite, chalcopyrite, and malachite have been found in a gangue of calcite and quartz, with associated pyrite, arsenopyrite, and pyrrhotite. The deposit consists of irregular replacement masses along a contact zone between metamorphic rocks and quartz diorite.

5.5 Observe a large dike on north (left).

6.3 The Mt. Adelaide Tonalite formation is present at the base of peak on right with a sliver of gneiss.

7.0 Gneiss outcrop.

7.2 Metasediments of Walker Basin/Kern Valley formations. 7.4 Limestone outcrop is in the roadcuts.

7.9 Claraville and Castle Rock granodiorite formations.

0.0 Junction with the Walker Basin Road. Observe the Bear Valley Tonalite. RESET ODOMETER.

1.5 A Quartz Aplite dike is present in the roadcut.

8.5 Piute Mountain School. This school is built underground.

## AREA MAP 16

8.8 Turn right on the Walker Basin\Keene Road. The Claraville Formation is on the left.

9.5 Following Weaver Creek, the hill to left (east) is a basalt/andesite cap of south directed tertiary volcanics.

10.6 Handy's Corner.

10.7 Volcanics are present to the right (west).

12.1 TWIN OAKS GENERAL STORE.

Quartz diorite and tertiary andesite intrusives are to the south and above the Claraville formation is the Walker Basin formation is to the west. The store used to be the Waker Basin Schoolhouse.

0.0 RESET ODOMETER TO ZERO AT THE GENERAL STORE. Go west toward Caliente

0.4 Limestone outcrop is to the right.

1.0 Intrusions in the roadcut and outcrop.

1.2 Amalie Mine and Mill

## STOP NO. 17; AMAILIE MINE AND MILL

Amalie (Amelia, Amalie) Mine. The Amalie Mine is located in the Loraine district, on a ridge a few hundred feet northwest of the junction of Sand Canyon and

Caliente Canyon.

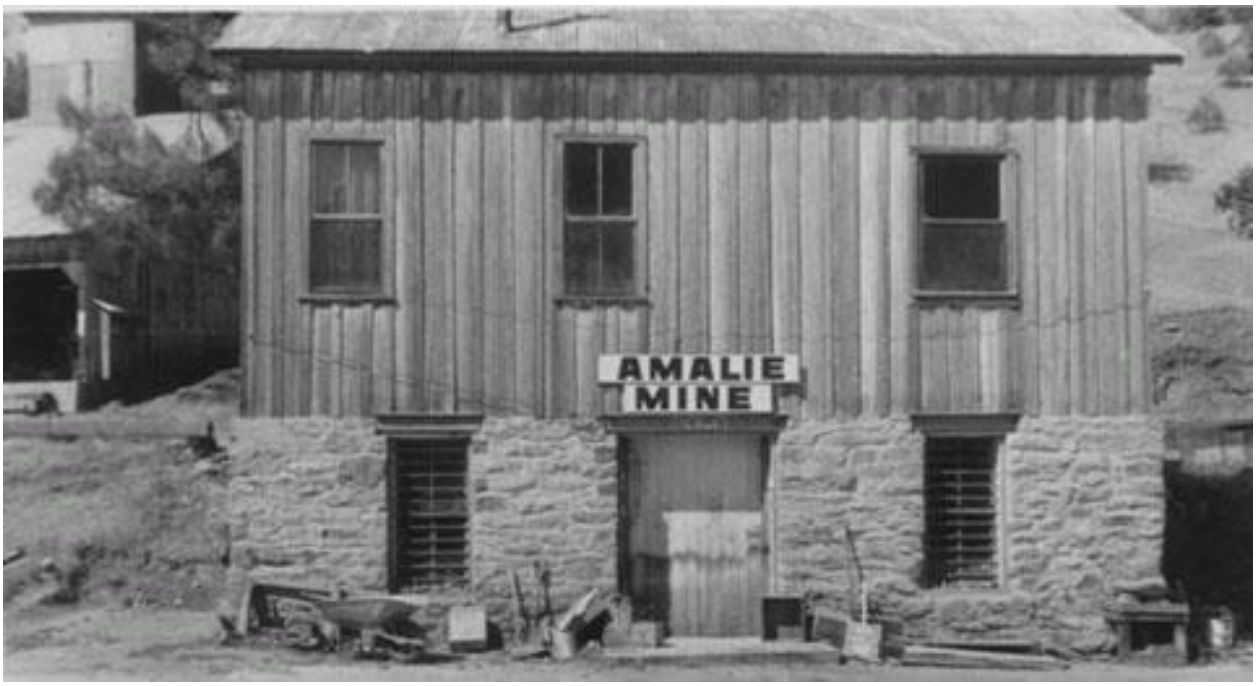



Figure 73. Amalia Mine Store and Restaurant circa 1910. BLM records.

Figure 74. Amalie Mine Store 2015.

The land on which the buildings are built, including the mill are on BLM land. Permision to enter the buildings or the mine must be obtained from the mining claimant. The main access adit leads to a hoist room and shaft which was burned by vandals in 1992. Scrapers removed the 1895 steam engine boiler that powered the steam engine for the mill in that era in 2005. BLM closed 18 hazardous mine features here in 2015-2016.

The earliest published record of the Amalie mine in 1894 gives the owner as C. Mohr of Caliente. The mine soon was purchased afterwards by the Amalie Mining Co. In 1896, a 16-ton Huntington mill was put into operation and development of the mine progressed rapidly until 1900. Mining has been intermittent since 1900, with production reported in 1905, 1908, 1912, 1928, 1935, and 1936. The total value of ore from the mine was reported to have been about $600,000 by 1912.

The mine area is underlain by pre-Cretaceous metasedimentary rocks which form a large roof pendant in Mesozoic quartz diori te. Tertiary rhyol i te porphyry dikes were intruded into the metasedimentary rocks along a 300-foot-wide zone trending generally northwest. Silver mineralization apparently accompanied a late phase of this intrusion. Quartz diorite crops out 1,500 feet northwest of the main workings and 500 feet to the southeast.

Mineralization is in three subparallel veins 8 inches to 4 feet wide. The Main vein crops out at the crest of a northwest-trending ridge between Sand Canyon to the east and Caliente Canyon to the south. The vein is mostly in rhyolite porphyry, but locally schist forms one or both walls of the vein. Laterally the vein can be traced 600 to 800 feet and has been explored 600 feet down the dip. The vein is composed mainly of fault gouge and quartz with pyrite and hydrous iron oxides. The most common ore minerals are cerargyrite, bromyrite, and free gold, but argentite, proustite, and tetrahedrite were reported in 1896.

The Occidental vein crops out 200 feet southwest of the mine shaft which is on the Main vein. The southeastern part of this vein swings northward and appears to join the southeastern end of the Main vein at a point about 500 feet southeast of the shaft. An ore body 200 feet long was mined from the surface to below the 250 foot level near the intersection of the two veins. The Virginia vein, not as extensively developed, is about 450 feet northeast of the Main vein.

Figure 75. Amalia Mill 2015.Photo by Gregg Wilkerson.

Figure 76. Amalia Mill, 2015. Photo by Gregg Wilkerson.

Figure 77. Foundations of Amalia Hoist House for Main Shaft. Photo by Gregg Wilkerson, 2015.

Figure 78. Amalia Main Haulage Drift, 2015. Photo by Gregg Wilkerson.

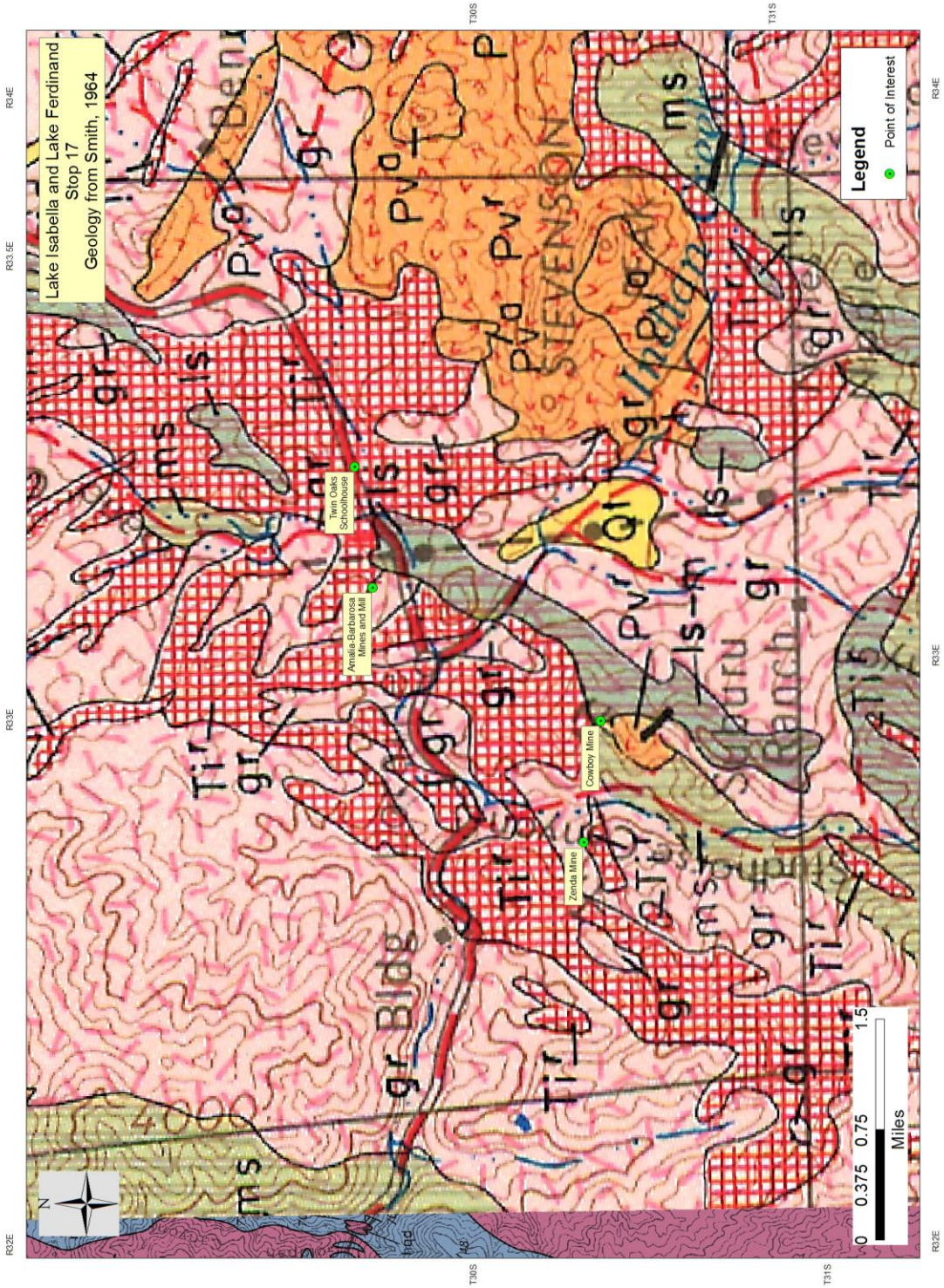



Figure 79. Geologic map of the Amalie Mine and surrounding area. Adapted from Ross, 1995.

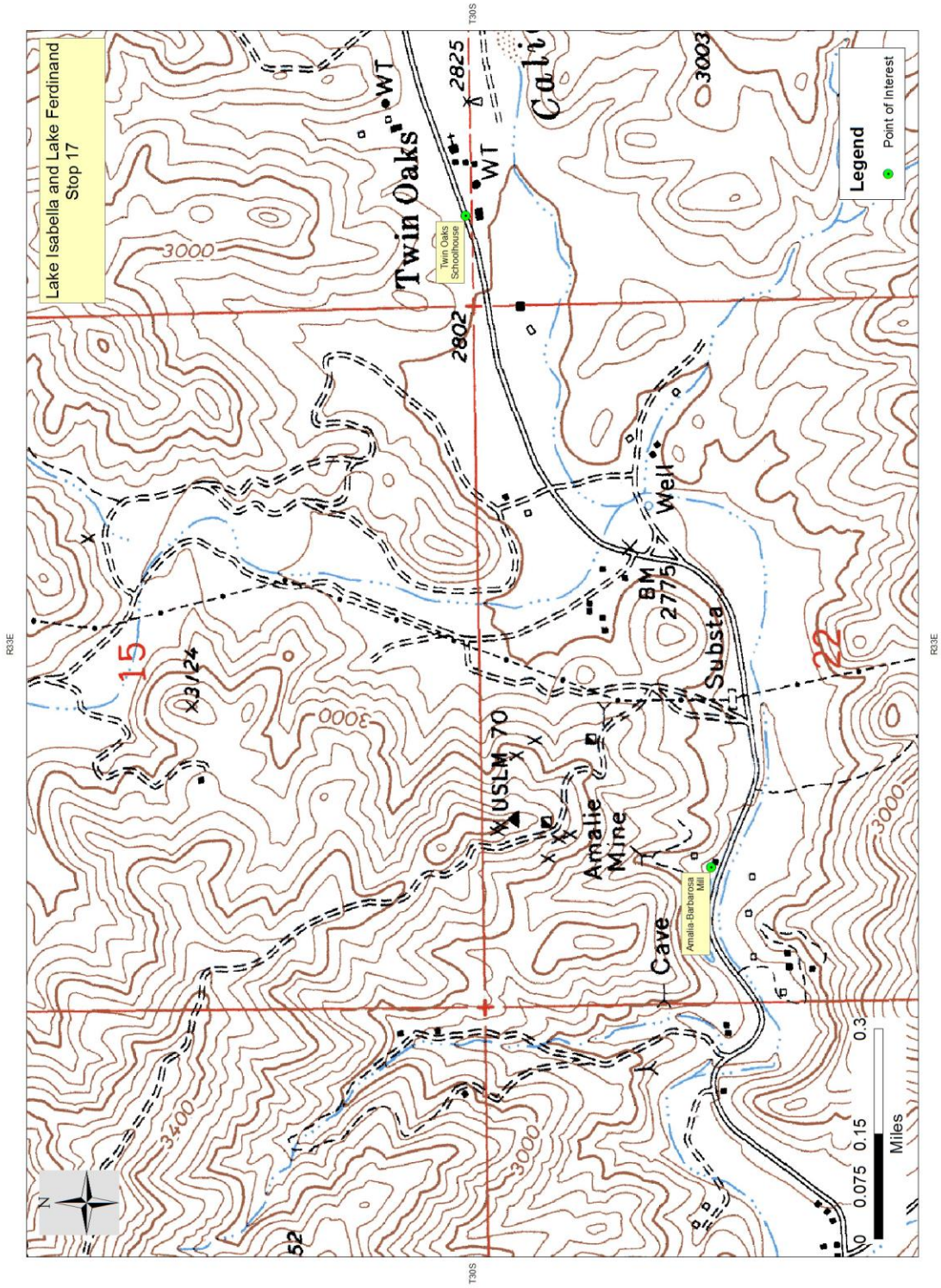



Figure 80. Topographic map of the Amalia Mine and surrounding area.

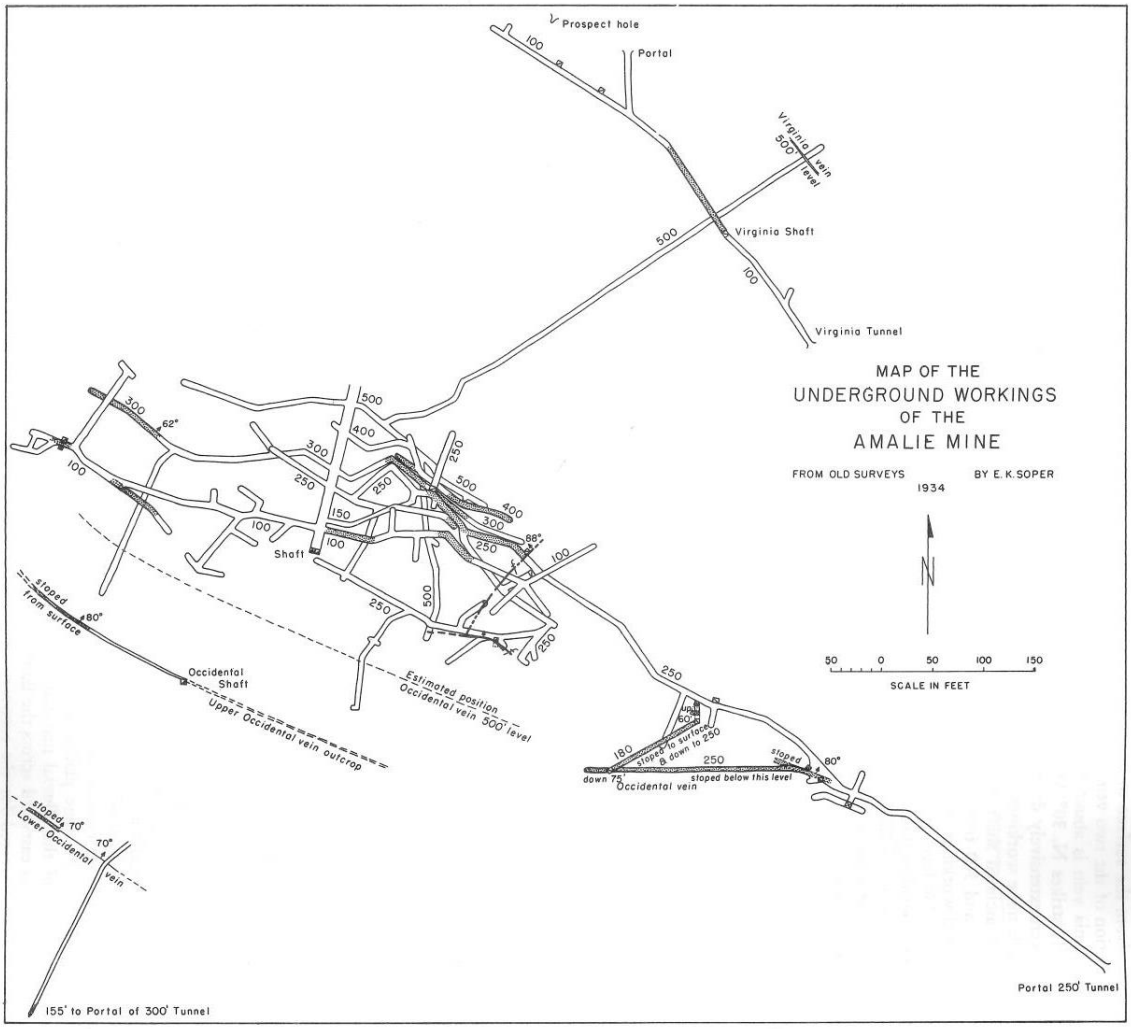



Figure 38. Composite plan of the Amalie mine.

Figure 81. Underground workings of the Amalia Mine. From Troxel and Morton, 1968.

The Amalie mine workings consist of a 560-foot, two-compartment inclined shaft with six levels at 100, 150, 250, 300, 400, and 500 feet below the shaft collar. Horizontal workings on the levels measure about 5,000 feet. The 250 level, with 2,000 feet of workings on the Main and Occidental veins, is the most extensive, and is the only level on the Main vein accessible by an adit. The portal is 800 feet southeast of the shaft, at the southeastern base of the ridge. The Virginia vein is developed by a 240-foot drift adit driven N. 30 ° W. from the south slope of a small draw northeast of the shaft on the Main vein.

## BARBAROSA MINE

About one mile to the northwest is the Barbarossa Mine. The Barbarossa Mine is located in the Loraine district, one mile north of Loraine on a high ridge between Sand and Sycamore Canyons.

The Barbarossa mine was worked mostly during two periods in the early 1900 1 s. In 1904 approximately 2,000 tons of ore was mined, and an additional 900 tons was shipped between 1912 and 1914. The ore averaged one ounce of gold and one ounce of silver per ton. Ore was hauled by wagon to Amalie mill one mile south of the Barbarossa mine. The mine has been idle, except for development work, since 1914.

The ore was obtained from the Barbarossa vein which is contained in a porphyritic rhyolite dike a few tens of feet thick. The dike has intruded Mesozoic quartz diorite. The vein is 2 to 6 feet wide and can be traced about 400 feet on the surface. The south end of the vein is terminated by a fault. The north end of the vein apparently splits into several small fractures which can be traced only a few feet farther northwest. Porphyritic rhyolite forms both walls of the vein at the surface but at some points underground quartz diorite forms the footwall. The vein walls are well-defined faults which pinch and swell abruptly. The vein is composed principally of quartz with sparsely disseminated fine-grained pyrite; free gold and an undetermined silver mineral are the only ore minerals.

A single-compartment 137-foot inclined shaft extends from the surface to the upper or Finley level at 70 feet and middle level at 137 feet. The two levels measure more than 700 feet of drifts and crosscuts. The upper level is also accessible by a 100-foot crosscut driven N. 70 ° W. from a point 130 feet east of the collar of the shaft. From the 137-foot level the vein on both sides of the shaft has been mined about equal distances to extract an ore body 160 feet long and 4 feet wide.

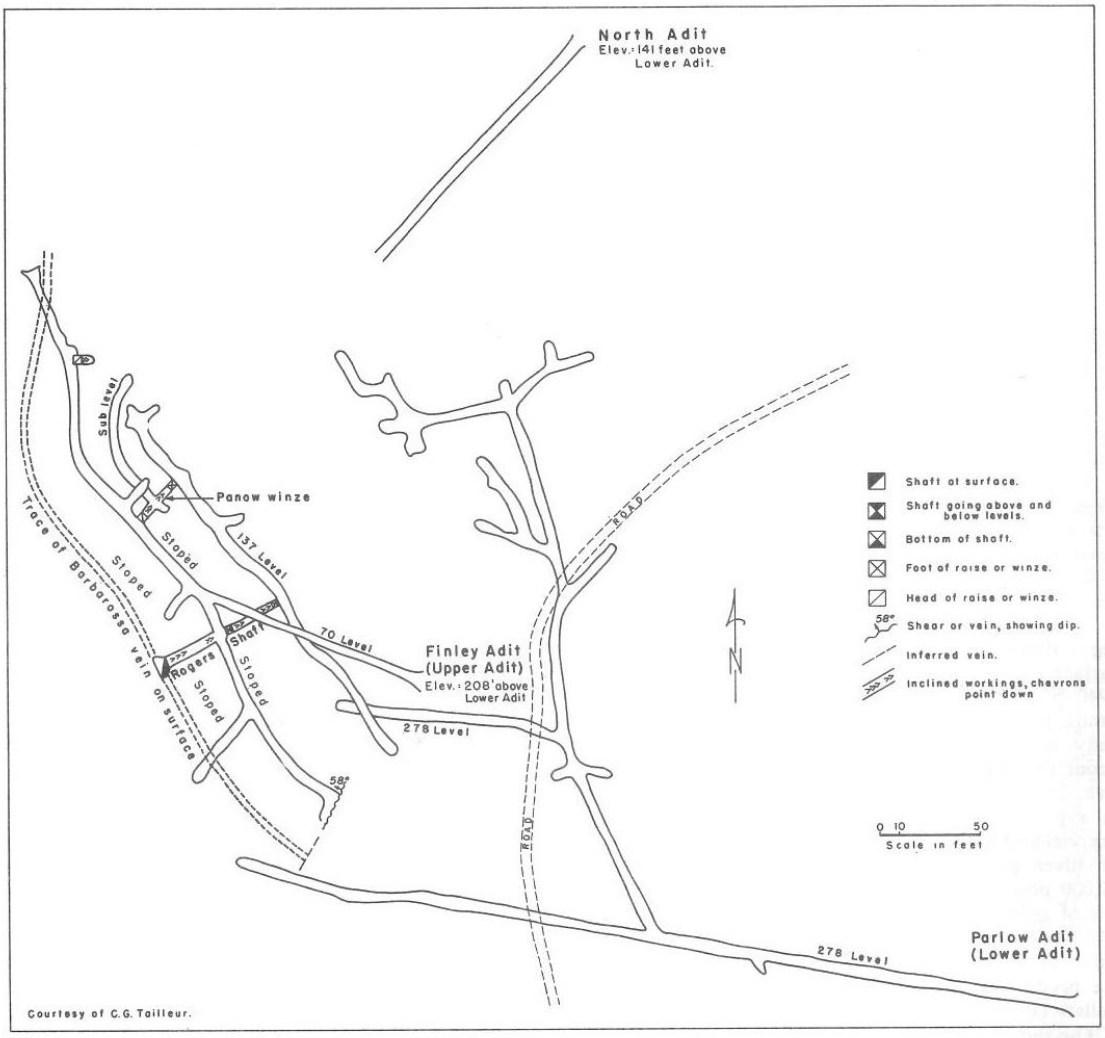



Figure 39. Composite plan of the Barbarossa mine.

Figure 82. Underground workings of the Barbarosa Mine.

A lower level was developed from a point 370 feet southeast of and 208 feet below the portal of the upper level. The level consisted of a 416-foot crosscut adit driven N. 80 ° W. and about 1,000 feet of appended lateral workings driven in an attempt to find other ore bodies. Al though additional veins were found in the lower workings none was sufficient grade to mine at a profit. Another crosscut adit 330 feet northeast of the upper portal was driven 145 feet S. 45 ° W. toward the 137 level, but lacks 145 feet of connecting with it.

Figure 83. Adit at Barbarosa Mine, 2015. Photo by Gregg Wilkerson.

0.0 AFTER STOP RESET THE ODOMETER. Go west down Caliente Creek Road toward the settlement of Caliente.

0.6. At the Loraine Indian Creek/Caliente Creek Road junction, observe the Bear Valley Tonalite Formation. This is the location of the old town of Loraine.

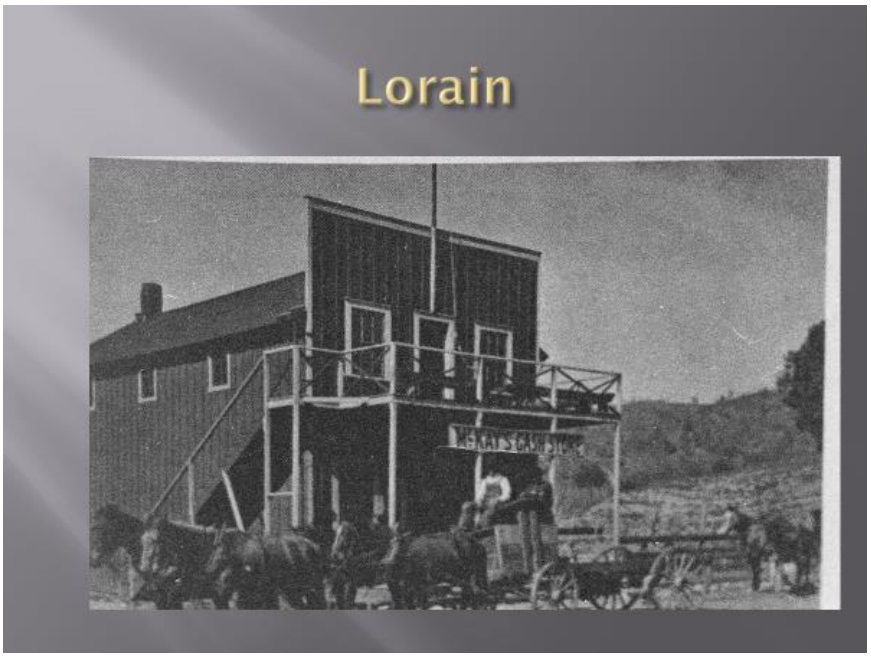



Figure 84. Loraine General Store circa 1890. BLM records

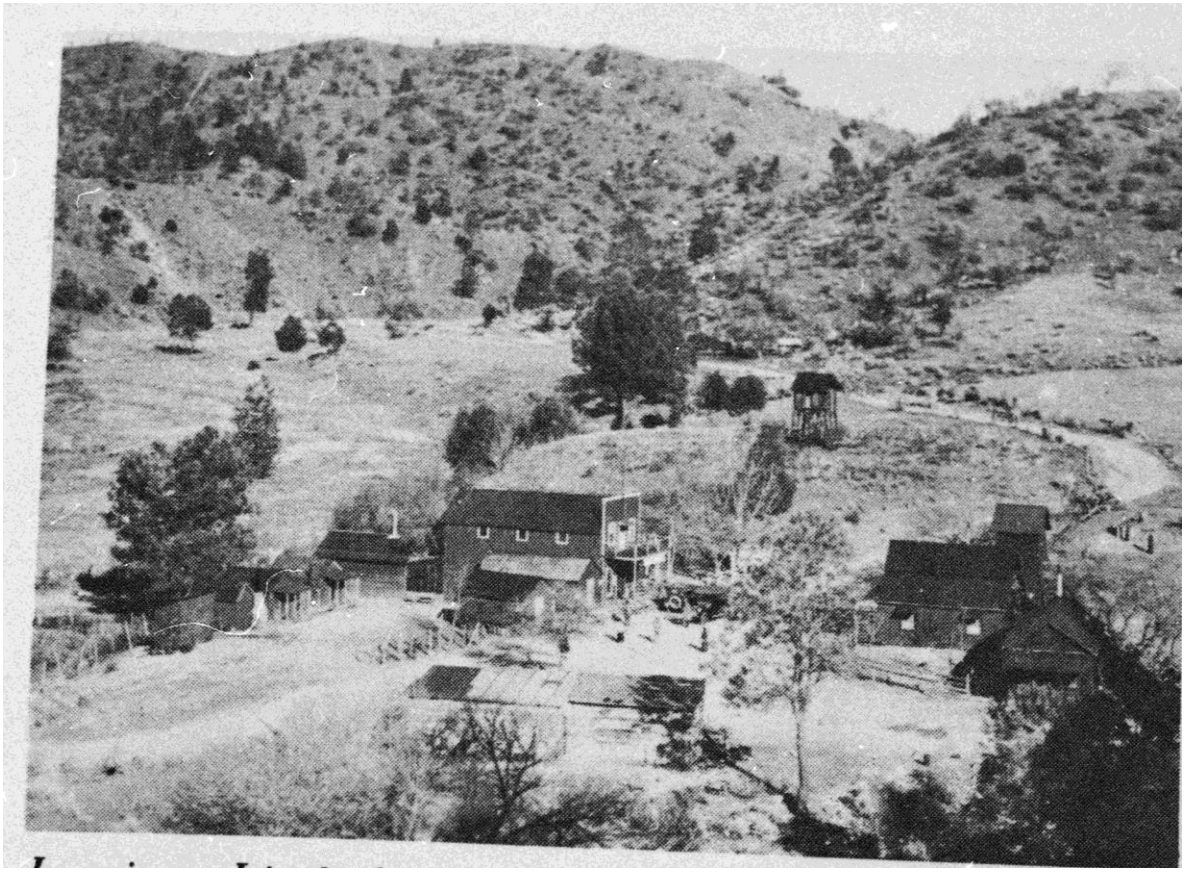


Figure 85. Town of Loraine circa 1890. BLM records.

1.5 Observe a the stream terrace to right.

2.3 Volcanics are in contact with the Bear Valley Tonalite.

2.4 Road on the left goes south up to the Gold Peak, Cowboy Mine, and Zenda Mines. This is private land and you need permission to go through the gate.

## GOLDEN PEAK AND COWBOY MINES

These mines were formerly named the Zada and Old Cowboy. They included the Standard and Golden Cross Prospects which were formerly the Edith, the Elipse, and the Paris prospects. These comprise eight unpatented silver claims, that are located in the Loraine District on the east slope of Studhorse Canyon and a quarter of a mile northwest of Eagle's Nest Peak.

The mines were discovered about 1900 and developed independently. The most productive period was from 1901 to 1906, when the Cowboy yielded 70 rail cars of ore which grossed $125 per ton (1906) and the Gold Peak yielded 110 rail cars of ore which grossed $89 per ton (1906). About 600 further tons of ore were mined through 1920. Since then very little mining has been done.
Both mine workings are on parallel average four feet wide east-striking veins that occupy fractures or sheeting planes in east-trending rhyolite dikes intruding into a pre- Cretaceous metasedimentary rocks. The silver to gold ratio of the ore mined was 180:1. Development of the Cowboy vein was done along five east-driven drift adits of about 1600 feet of adits and appended workings. Development of the Gold Peak vein was four north-driven crosscut adits on three levels.

The Cowboy Mine has Butte Montana-style cribbing in the stopes. These are 4ft x 4ft x 4 ft squares that fill up the stopes and keep them from collapsing. The upper Cowboy workings are dry and that is why these 100+ year old workings are still standing. Do not go inside without permission from BLM! The interior workings are dangerous.

## ZENDA MINE

Metasediments and Bear Valley Formations are exposed in this mining area. Zenda Mine. The Zenda Mine is located two miles southwest of Loraine on a high ridge between Studhorse and Big Last Chance Canyons. The Zenda is on BLM land. Permission from the mining claimant is needed to enter buildings or mine workings. There are some dangerous stopes and adits at the Zenda. Workings should not be entered except by authorized personel.

The oldest records indicate that the Zenda was developed by 1904 and in production status by 1909. The first ore was mined in 1909. The first production of two hundred tons of ore were milled in a 10-stamp mill erected on the property. Relatively small amounts of ore were mined at intermittent intervals from 1910 until 1922 when the mine was purchased by a new owner. The new company installed a 150 ton ball mill and cyanide plant and during the subsequent 4 year period mined over 90% of the mine's total recorded output. Little mining has been done since 1928. From 1909 to 1958, a total of about 54,000 tons of ore was mined which contained an average of 0.6 ounces of gold and 2 ounces of silver per ton.

Most of the ore was mined from a glory-hold, the bottom of which is connected by an extraction raise with a long crosscut adit driven N 30 degrees E. from the mill site level. The mill site is 550 feet below the outcrop of the vein. The length of the crosscut was not determined, but an extraction raise was driven from the crosscut at a point 350 feet from the portal of the crosscut adit. Several hundred feet of additional workings were driven on the vein on levels above the crosscut adit.

0.0 RESET ODOMETER TO ZERO at turn-off to Zenda and Cowboy Mines. As you drive west toward Caliente, observe The Bear Valley Formation is in the roadcuts.

0.5 Metasediments are on the right.

1.0 Last Chance Canyon

## AREA MAP 17

1.5 Bear Valley Formation is fractured in the roadcuts.

2.0 Aunte Rosa Mine Site

3.2 Limestone is in contact with Quartzite in the roadcuts.

3.6 Bear Valley Formation is in the roadcuts.

5.5 Fractured Bear Valley Formation is in the roadcuts.

5.6 To the left is a visual fracture pattern in the roadcut.

6.4 An old alluvial terrace is cut by new stream activity.

7.2 An alluvial fan is on the right.

9.3 Turn left at the Caliente Road/Caliente-Bodfish Road. State Historical Marker #757.

## AREA MAP 18

10.6 Pegmatites are present in the Bear Valley Formations.

11.3 Sedimentary formations are present on the left.

12.1 The town of Caliente. Originally the town was called Allen's Camp after a packer who supplied the mining towns of Havilah and Kernville in the 1860's. Caliente was a place where supplies were transferred from wagons to muleback.

At the height of the railroad building era, the town of Caliente had 200 permanent residents and 3000 railroad builders. At one point, the town had several general stores, three to four barber shops and blacksmith forges, a number of other shops, twenty saloons, three hotels, and a section almost as large as the rest of the town reserved for Chinese gambling dens and washhouses.

By March, 1876, the railroad crews moved sixteen miles farther along the railbeds. The stores, saloons, and houses were torn down and moved to Tehachapi or Bakersfield.

12.2 Crossing the railroad tracks in Caliente. Between Caliente and Tehachapi, the straight railbed distance covered is a half mile in altitude over fourteen miles. Using maximum gradients and the narrowest curves allowed by law, the Southern Pacific built the 28 mile (44.8 kilometers) long railbed through 17 tunnels. The tunnels had a total length of 7684 feet (1.5 kilometers). After the hairpin curve near Caliente and over an air distance of one mile, the railbed doubles back on itself after seven miles and six tunnels. Called the 'Tehachapi Loop', the railbed winds up Tehachapi Creek to Tunnel # 9, where the line curves around to the left and passes over the hole in a complete circle. Planned to gain 77 feet (23.5 meters) in altitude, the famous Tehachapi Loop, designed by William Hood, is considered to be the outstanding engineering accomplishment of early railroad history.

2.5.1 Intersection with Edison-Bena Roads.

13.9 Rail crossing.

0.0 HIGHWAY 58. RESET ODOMETER TO ZERO.

## 1952 ARVIN-TEHACHAPI EARTHQUAKE

The White Wolf fault is to west at base of Bear Mountain downhill of this point. The White Wolf fault, on July 22, 1952, near Wheeler Ridge at the Grapevine, was the epicenter of a 7. 6-7. 7 magnitude earthquake, the strongest quake in California since 1906. The White Wolf is a high angle reverse fault dipping southeast at 45 ° at right angle in the northeast direction of the San Andreas Fault Zone. Vertical displacement is 10,000+ feet, with very little horizontal displacement.

Figure 86. Bakersfield Library. Fron NORA files

Ground fracturing occurred during the 1952 earthquake along almost the entire 17-mile at or very near the trace of the White Wolf Fault. Up slope from the White Wolf Fault many small ruptures occurred on the steep slopes of Bear Mountain and on both sides of Sycamore Canyon up to the 4,000 foot contour. The ruptures measured 10 to about 200 feet long and either followed a contour or in most cases were concave down slope. The ruptures always gaped and dipped steeply downhill with the hanging block sliding downhill one or several feet. One of the ruptures on the south slope of Bear Mountain slid down as much as 30 feet. The small shallow landslide features which developed only in the soil or in weathered or shattered quartz diorite on steep slopes, were protected from gravitational settling of this material during lurching resulting from the main shock.

The greatest and most continuous zone of ruptures is along the White Wolf Fault portion following the base of the steep 5,000-foot-high granitic scarp of Bear Mountain beginning at a point 4 miles east of Arvin and extending continuously for 3 miles northeastward, then intermittently for another 2 miles to the canyon south of the White Wolf ranch house. The entire mountain block on the southeast side of this zone of fracture was elevated 1 or 2 feet, and thrust toward the northwest. The fracturing along this 5-mile portion of the White Wolf fault is consequently characterized by thrust fault scarplets usually facing northwest, and

associated pressure ridges or mole tracks. In most places the upthrust block formed a single scraplet, a foot or two high and traceable for several hundred feet. All the scarplets along this portion of the fault were miniature overthrusts with the plane of movement dipping southeast at low angles with displacement toward the northwest or west of north.

1.3 Arvin/223 Highway Junction.

2.3 Note the diorite with xenocrysts in the roadcut

3.4 The Edison fault crosses Highway 58.

The Edison fault, on August 22, 1952, was the epicenter of a 5.6 magnitude earthquake. This strong aftershock, occurring closer to Bakersfield than the quake in July 21, 1952, caused $45,000,000 (1952 prices) estimated damages within the city of Bakersfield.

The east-west Edison fault is a normal fault. The coarse grained Bealville fanglomerate is in the north downthrown block and the crystalline basement rock is in the upthrown south block. The surface trace of the fault, while quite irregular toward the east, extends west with only minor variations in dip and strike. The fault surface is marked by a dense band of olive-gray to chocolate-brown fine sandy gouge. The gouge distinctively lacks any coarse sand or granitic debris, and is considered a product of the faulting itself. A two-mile stretch of fault outcrop which formerly could be followed as an unvegetated strip of crumbly material was graded out during the construction of present Highway 58. The large scarp that is mapped in the subsurface along this fault suggests an area of high relief during the time of deposition of the Bealville fanglomerate that could account for the coarseness of that unit.

3.5 Gabbro contact is in the roadcuts.

4.2 Gabbro with intrusive dikes is in the roadcuts.

5.4 The Walker Formation is in the hill to the right.

9. 6 Caliente Creek drainage area.

Water inflow is from the Walker, Caliente, and Tehachapi Creeks which then drain naturally to the south into the Lamont areas. In the 1983 the high water conditions during a flood stage eroded and destroyed the north embankment and one lane of the Highway 58.

10.1 Sand dune hill.

14. 8 The Edison Oilfield is located on both the left and right sides of the freeway.

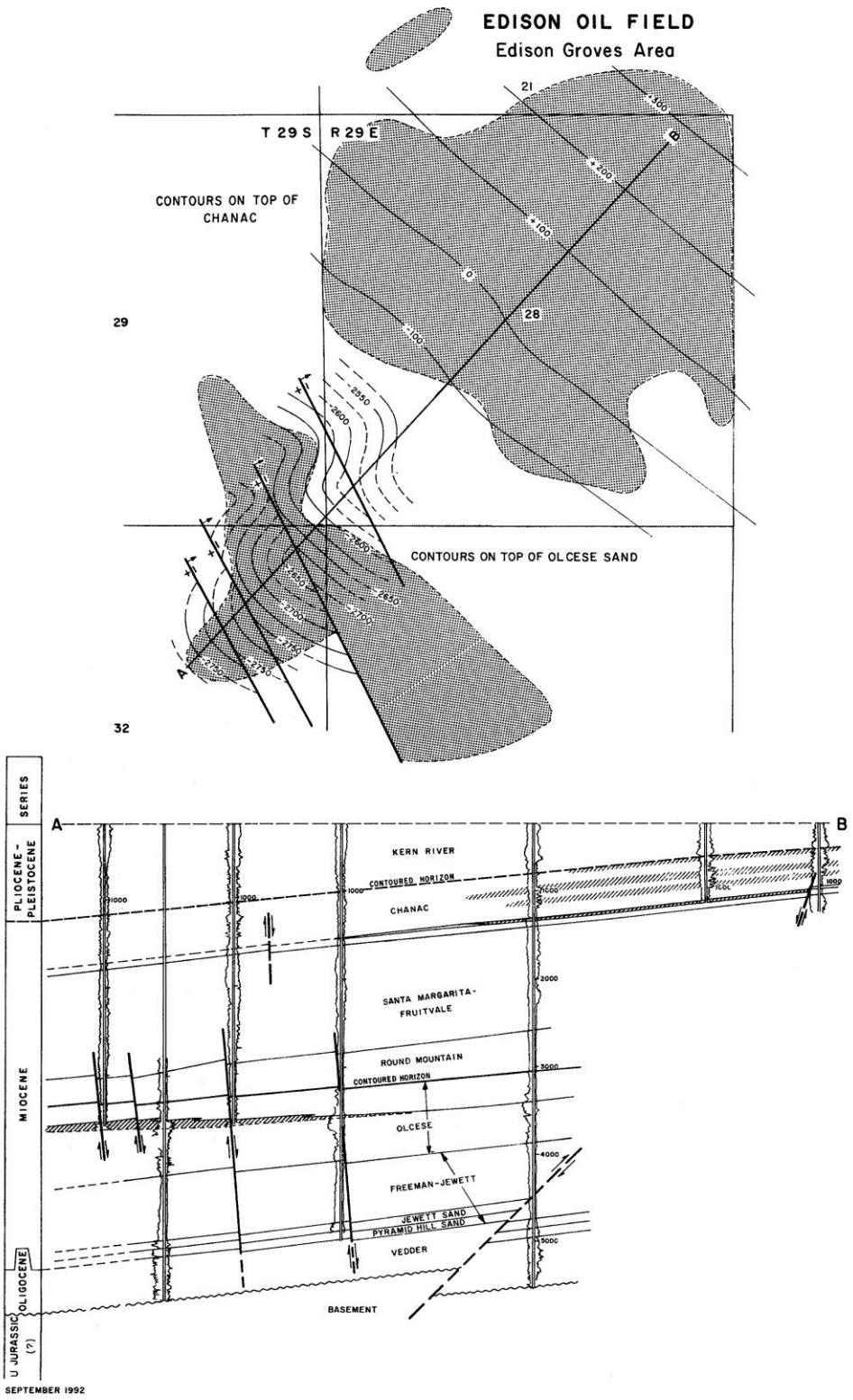



Figure 87. Edison Oil Field. From DOGGR, 2002.

Looking both left (south) and right (north) of the road, note the distant

topographic high on which the main portion of the Edison oilfield is situated. this high may be and remnant of a large alluvial fan deposited in the past by Caliente Creek. Another conjecture is that this topographic high may be the result of the structural uplift responsible for the Edison Field. Production from the main portion of the field is from Kern River-Chanac beds, marine beds in the upper and middle Miocene, and fractured basement schist.

15.6 To the right (north) just before Edison Highway is a California Historical Monument #660 commemorating the Jedediah Smith Trial. Although this marker is temporarily without a plaque, the previous one read:

"Jedediah Strong Smith. Near this spot about the 1st of February, 1827, Jedediah Strong Smith, first U. S. citizen to reach Mexican California over land, passed through the present area of Kern Canyon with his party of fur trappers from the San Gabriel Mission. Smith and his men were trail blazers whose exploits soon led to the conquest of California."

To the left (north) of the road, the Kern River Formation be seen can as the gently sloping foothills.

22.3 Union Avenue exit.

END OF FIELD TRIP

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## APPENDIX 1: DESCRIPTION OF ROCK TYPES

### SEDIMENTARY ROCKS

KERN RIVER (Pliocene/Pleistocene): Gravel, sand, clay

PLUTONIC ROCKS

**MEDIUM TO COURSE-GRAINED GRANITES**

GRANITE OF KERN RIVER (Late Cretaceous):Medium to dark grey containing abundant K-feldspar and common small inclusions and centimeter-size rounded clots of mafic minerals. K/Ar biotite ages 87-89 m.y. and Rb/Sr whole rock age 90 m.y.

GRANITE OF CANNELL CREEK (Early Cretaceous): A strongly foliated (cataclastically or protoclastically deformed rock) containing varying amounts of biotie. Rb/Sr whole-rock ages 108 m.y. K/Ar biotite age (reset?) 50 m.y. and 55 m.y. This resetting may be due to deformation, since no other intrusives of this age are known in the region that could have reset the K/Ar system.

**FINE-GRAINED GRANODIORITE**

GRANODIORITE OF ALTA SIERRA (Late Cretaceous): Characterized by scattered course biotite crystals in a fine-grained matrix. Dikes of unit intrude the granodiorite of Mount Adelaide, and textural gradations between the two masses suggest that the Alta Sierra mass represents a slightly younger, finer grained pulse of the Mount Adelaide mass. K/Ar biotite ages 89-90 m.y.

GRANODIORITE OF LIME POINT (Late Cretaceous): A small undistinguished plug of biotite granodiorite along the south shore of Isabella Lake east of Lime Point, and a smaller plug across the lake to the north.

**MEDIUM- TO COURSE-GRAINED GRANODIORITE**

GRANODIORITE OF CASTLE ROCK (Late Cretaceous): Mostly porphyritic containing pink to salmon K-feldspar phenocrysts (max 5 cm diam). Modal average is close to granite field. Strong protoclastic or cataclastic deformation occurs locally along the west margin of the body, particularly near the north boundary of the map area. The unit forms part of a larger body that is probably

continuous, across an unmapped area, with the granite of White Mountain to the north. Rb/Sr whole-rock ages 86-90 m.y. K/Ar biotite age 81 m.y.



GRANODIORITE OF RABBIT ISLAND (Early Cretaceous): A relatively dark rock containing abundant mafic minerals, but generally much less hornblende than in the tonalite of Bear Valley and the granodiorite of Dunlap Meadow. Rb/Sr whole rock ages 113 m.y. K/Ar biotite (reset due to metamorphism?) age is 81 m.y.

**TONALITE**

TONALITE OF BEAR VALLEY SPRINGS (Early Cretaceous): A large body of hornblende-biotite tonalite to granodiorite, containing abundant mafic ovoid inclusions, that extends as far southward as the Garlock Fault. Modal average in the map area is just in the granodiorite field at the tonalite boundary, but the total unit so far mapped averages tonalite. Pb-U zircon ages are 100 m.y. K/Ar biotite ages (reset?) are 86 m.y. K/Ar hornblende ages (reset?) are 88 m.y.

<u>METAMORPHIC ROCKS</u>

METASEDIMENTARY ROCKS OF LONG CANYON (JURASSIC AND/OR TRIASSIC): A generally well-layered (bedded?) sequence of siliceous to peltic schist (in part coarse and containing andalusite and sillimanite) pure to impure quartzite, marble, and calc-hornsfels. The unit exposed immediately south and north of Isabella Lake resembles lower Paleozoic rocks of the Cordilleran miogeocline, but about 6 km southwest of Weldon, in the midst of these "Paleozoic appearing" rocks, bivalves have been recovered that are Late Triassic to Early Jurassic in age.

QUARTZITE OF FAIRVIEW (Mesozoic): Dark, fine-grained to pebbly quartz-rich, thick-bedded to massive quartzite and lesser schist. Locally marble is abundant, and some banded chert(?) is present. Angular to subrounded clasts,

largely unsorted, suggest turbidity-current deposition for these rocks. Some tuffaceous layers are present, and local chlorite-rich layers also suggest volcanic parentage.

METAVOLCANIC ROCKS OF FRENCH GULCH (Mesozoic): Various felsic to intermediate volcanic rocks and tuff. The unit contains local layers of marble and metachert(?). Conspicuous both north and south of Isabella Lake are felsic layers with strong fluxion structure that probably represent ash-flow layers.

# APPENDIX 2: ROAD MAPS