

**The Donner Summit**

*Heirloom*



*History and stories of the Donner Summit Historical Society*

**November, 2020 issue #147**

# Piracy on Donner Summit

**Stream Piracy – The Yuba Steals the Bear River’s Headwaters –  
a true history of a geological crime.**

It's an article of faith in the literary community that every good story deserves a pirate episode. It's just human nature. The story of Donner Summit is certainly extraordinarily rich. There is adventure and drama. There is pathos. There is joy. There is the very best of human nature and there is the very worst. There is man against nature and the elements and there is man triumphant. That's all pure literature which the Heirloom endeavors to bring to our readers every month. So, the literature of Donner Summit deserves a piracy story.

This piracy episode has been lying in the DSHS computers since 2014, waiting for exposure. It came from our desire to learn ever more about Donner Summit and so we sent a staff member to the Sierra College in Rocklin to take a course in California Sierra geology. The major part of the class was a transect (a term those of us in the sciences use to indicate cutting across and cataloging - in this case, geological features). Naturally that would include Donner Summit and some very ancient history.

The upshot was a paper on piracy on Donner Summit which earned our staff member an "A" in the course and so now you have the regular validation of this article's content because it appears in the Heirloom but also because it earned the professor's approval.

# Story Locations in this Issue

The Bear River pg 3

Source of the Yuba on Donner Summit pg 3

Map pg 10

Vanderford's pg 14



Tunnel 6 pg 21

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Find us on 

Unless otherwise noted, the photographs and other historical ephemera in The Heirloom's pages come from the Norm Saylor collection at the Donner Summit Historical Society



Whose Headwaters is This?

Current source of the So. Fork of the Yuba River on Donner Summit. It is a marvelous wild flower garden in summer. See the map on page 10 for your own visit. Wild flowers get waist high in July.

# Piracy on Donner Summit

## Yuba River Steals the Bear River's Headwaters. Yuba Decapitates the Bear

The idea of “Stream Piracy,” a term the eclectically knowledgeable [Heirloom](#) staff had never heard of, was galvanizing. We had to find out more, especially because the “Stream Piracy” had occurred on Donner Summit.

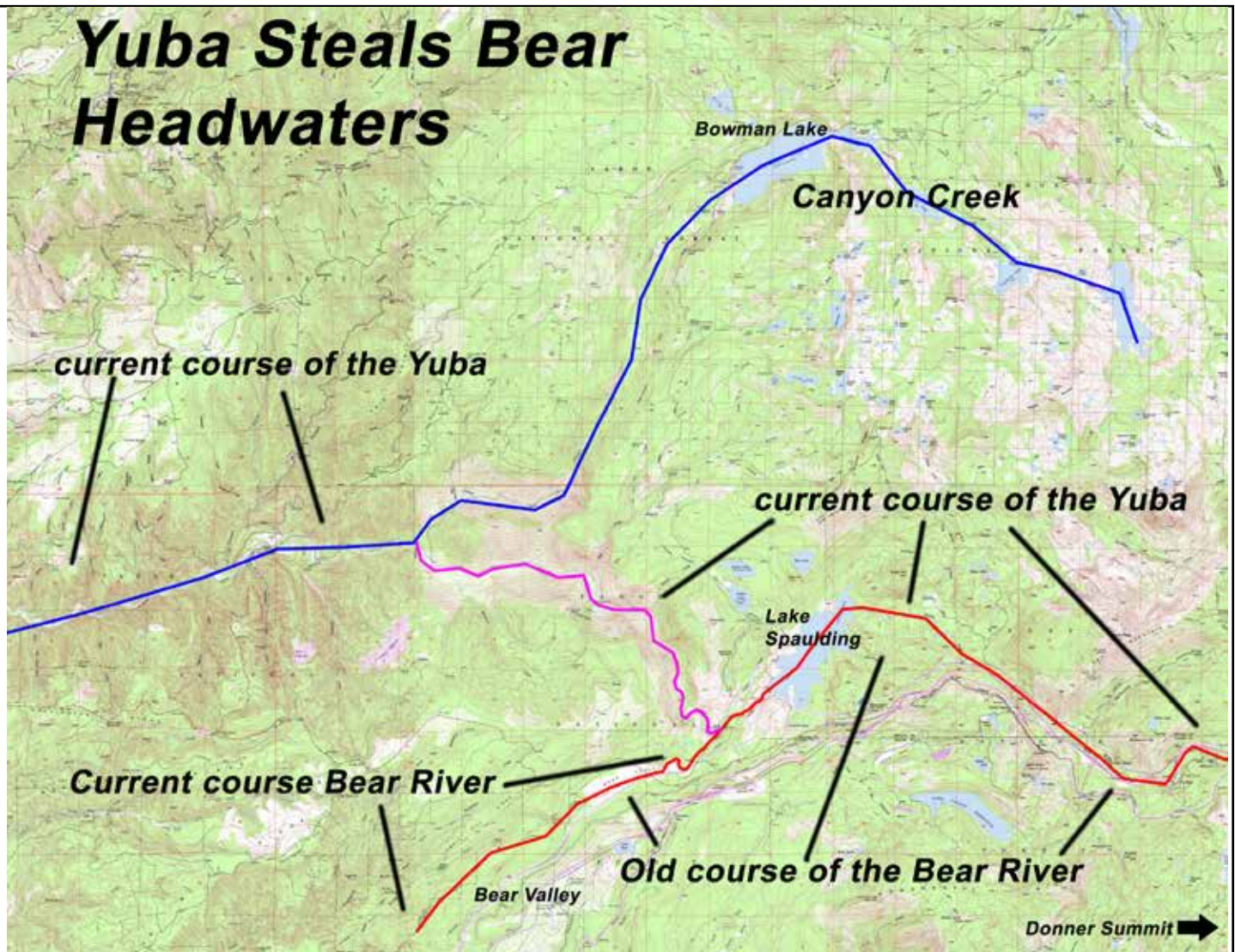
Stream Piracy could be a good story. For years we've searched old newspapers and other sources for “sexy” Donner Summit stories, some of which you've read in the [Heirloom](#). There are the big stories: how Tunnel 6 was made, the many firsts on Donner Summit, Chinese, etc. You will also remember the gold that's still sitting in the Yuba River after its owner was killed in Rainbow Tavern (see our Rainbow Lodge 20 Mile Museum sign) or the robbery at the Sisson Egbert store on Donner Summit ([Heirloom](#) April, '12), Edwin Bryant's somersaulting mule in 1846 ([Heirloom](#) April, '13), etc. There are lots to come too: blindfolded mules, the first locomotive over the Summit... but that's why you have a subscription. Those are all stories for future [Heirlooms](#). This month it's “Stream Piracy.”

Stream Piracy sounds really great. So we imagined the headlines: “Stream Piracy - Yuba Steals Bear's Headwaters” or “Yuba Decapitates the Bear.” They would pique readers' interests – a story you have never heard of but also could probably not imagine, particularly since the Yuba seems like such a nice river. It is calm, staid, and an asset to Donner Summit.

So we delved in with gusto scouring topo maps, searching the Internet, reading erudite treatises (“Diversion of the Upper Bear: Glacial diffluence and Quaternary erosion, Sierra Nevada, California,” and “Late Pleistocene Glaciations in the Northwestern Sierra Nevada”), re-reading books ([Assembling California](#)), perusing the [Journal of Electricity Power and Gas](#) (December, 1913), and sending the DSHS Mobile Historical Research Team (MHRT) out into the field for first hand investigations on two occasions. Nothing is too good for our readers.

Unfortunately, after our field inspection, the story turns out to be less “sexy” than imagined. Still, it's a good story and it's good history.

# Yuba Steals Bear Headwaters



## So. Fork of the Yuba River

Today the So. Fork of the Yuba has its source on the flank of the saddle between Mt. Judah and Mt. Lincoln above the east end of Summit Valley. It almost gushes directly from the mountainside and is a very pretty spot to visit at the height of wildflower season when the flowers are waist high (see the picture at the top of the previous page). The source is directly below Roller Pass but you should not take that route to visit. The slope is extremely steep, the soil is loose, and it's dangerous. See the story and map on page 10 for the best access route.

From the source the So. Fork of the Yuba flows through Summit Valley, joining Castle Cr. which drains the north side of Boreal and all of Castle Valley (south and west of Castle Pk), through Van Norden, Soda Springs, Kingvale, Pla-Vada, Rainbow, Cisco and down to Lake Spaulding. It's been going that way for thousands of years but that's not the original route. What is now the source of the Yuba, used to be the source of the Bear. According to geologists, the Yuba stole the Bear's source. The Yuba decapitated the Bear. It is rare in the Sierra. There is only one other case of "Stream Piracy" happening. (James (2) - see the bibliography - remember, this was a college paper so citations are de rigueur.)

## The Yuba Decapitates the Bear

The original route of the So. Fork of the Yuba was what is now called Canyon Creek

Map of the original Bear - lower solid line. The upper solid line is the original So. Fork of the Yuba.

The Stream Piracy or decapitation occurred where the lower solid line hits the line connecting the two lines that goes northwest. At that point the Bear becomes only that which is to the southwest of the intersection. The So. Yuba becomes the east end of the lower solid line, the line that goes from the intersection to the upper line and the western portion of that upper line.



(James 1 pg 145). It was the Bear River that had its source on Donner Summit, on the flank of the saddle between Mt. Judah and Mt. Lincoln. That poor river had its head (headwaters) ripped off in a process geologists call “Stream Piracy.”

Today the Bear still exists but it is a shadow of the river that eroded Bear Valley (On Highway 20 just off I-80) along with earlier glacial action. The river starts toward the east end of Bear Valley just below Spaulding Dam (to the right of the photographs on this page). The South Yuba emerges from Spaulding Dam (though most of the flow goes into two canals taking water to electrical generation plants at Drum Forebay (Drum Canal) and Deer Creek Forebay (South Yuba Canal). That flow used to go directly west, into the Bear River’s channel but at some point in the past the flow shifted 110 degrees to the northwest into its current channel. You can see the sharp turn in the photographs on this page. Then it joined Canyon Creek and flowed southwest like all other good Sierra rivers. At the point of joining Canyon Creek the flow was the So. Fork of the Yuba.

### How to Decapitate a River

The classic view of how the Yuba came to pirate the Bear’s headwaters, or decapitate it, is some kind of fluvial erosion. Simply, that means the original Bear came down the river course and began eroding, perhaps where there was a cliff. That “fluvial headward erosion” cut into the bedrock and as softer rock was found the channel began to work its way northwest, toward Canyon Creek some miles away. Fluvial headward erosion is the process of water coming off a cliff hitting what’s below and beginning to dig a hole as water with sediments roil and boil. At the same time the water in Canyon Creek was also supposedly eroding going southeast. The two water courses’ erosion continued for a long time working towards each other until the barrier between was breached. Canyon Creek being lower and the old Bear channel being higher (today it is a definite hump - see the top picture on the on page 7) the water began flowing down the new So. Yuba River leaving the

Above: Panorama of the diversion of the Bear River. Upper right is Lake Spaulding and the dam. At right is the outflow of the So. Yuba from Lake Spaulding. In the foreground, right to left, is the new channel going northwest to join Canyon Creek beyond the picture edge to the left.

Below the diversion route from right to left across the bottom of the photograph



Bear “high and dry.”

This is best summarized by John McPhee in Assembling California (page 32), “...each eroding headward from opposite sides of the ridge, had struggled toward each other until the divide between them broke down, and the Bear, giving up its direction of flow, joined the Yuba and went the other way.”

An interesting aside here comes from Rudolph Van Norden in his article in Journal of Electricity Power and Gas (Dec. 13, 1913), “Lake Spaulding -Drum Power Development” where he mentions that it appears the So. Yuba River changed course, going north and once went through the Bear River Valley. He attributed the change “sometime, due to some cosmic disturbance.” Rudolph was the son for whom Van Norden Dam and the former Lake Van Norden are named. He was president of the So. Yuba Canal Co. before it was absorbed by PGE.

Stream Piracy is rare and there is only one other case in the Sierra (James 2). It is surprising that little has been written about this Bear River decapitation too. Those few writings about the event cite the cause as some kind of fluvial erosion (river or stream).

The author who has written the most is L Allen James, ironically of the Geography Dept at the University of South Carolina. He posits that the cause of the “diversion” was glacial action – not some kind of fluvial erosion. He says, “glaciation probably assisted in the capture if it did not cause it directly.” (James 2 pg 2)

James’ evidence is primarily the striations and grooves (pictured below) on the rock that show the direction flow of the glaciers that overlay Bear Valley and the Yuba river courses during at least three glacial periods in the past. (James 1 & 2) He also cites erosion patterns and amounts of erosion.

James says that the Bear Valley is composed of harder bedrock – Shoo Fly Bedrock Benches (James 2) – that were harder to erode. Just taking a look at the depth of the current So. Yuba Gorge shows how much easier that must have been to erode. At the MHRT’s lunch spot on the So. Yuba our on site research indicated that surrounding peaks were up to 2,600 feet above the river level (see pictures on pages 11 and 12). Since the old Bear channel did not erode as much, it must be of much harder material. The easier course was for the river to turn displaying a barbed pattern (110 degrees shift to the northwest), forming the current So. Yuba Gorge. Since there are striations and grooves (right) showing the movement of ice down the current channels, that means the timing of the diversion was “after Miocene-Pliocene volcanic epoch and supports a Quaternary age of derangement.” (James 1)

#### **In the Field**

So, having digested the theory of the change, our MHRT went into the field starting at the PGE Discovery Park on Bowman Rd. off



Above: large glacial erratic just above and west of the So. Yuba Gorge.

Below, the best example of glacial striations or grooves on bedrock showing movement of the glaciers following the normal Sierra river course: north-east to southwest. These grooves are on bedrock in Bear Valley near the current source of the Bear.





of Highway 20 in Bear Valley (see sidebars on page 10 for directions). We followed the trail through the park until we came to the foot bridge. There we headed east following an old road and then just following our internal compasses. As we came to rock formations we climbed on top to check the striations and grooves left from the glaciers coming down the old Bear River channel. Glaciers did flow in the east west direction AND in the direction of the So. Yuba Gorge, the route of the diversion. After about a third of a mile we ended up on top of the sharp drop off into the So. Yuba Gorge. It is a dramatic view (photos pg 5). Here, clearly, the river changed course. We then headed for the current source of the Bear River and noted that the bedrock is very hard and there is quite an elevation change between where the Yuba now flows and the current source of the Bear. It's quite a lump (photo above). It is easy to see here that erosion stopped in the westward direction and continued in the 110 degree northwest direction as described by James. That could only have happened if the rock under the new channel is softer than what is now the lump that the river did not continue to erode.

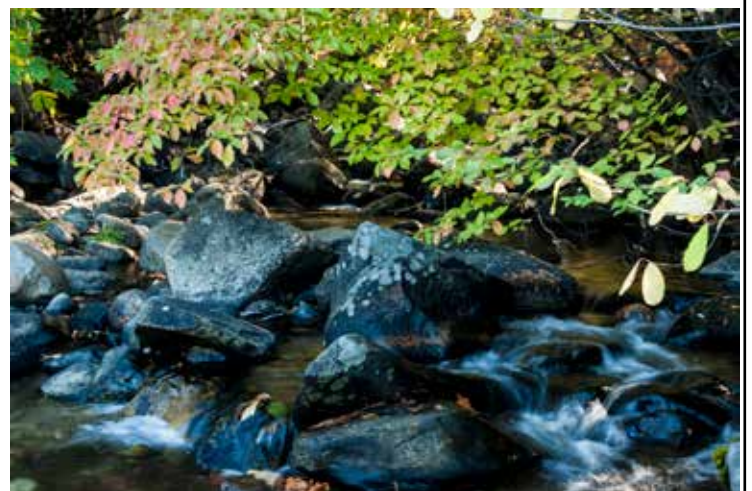
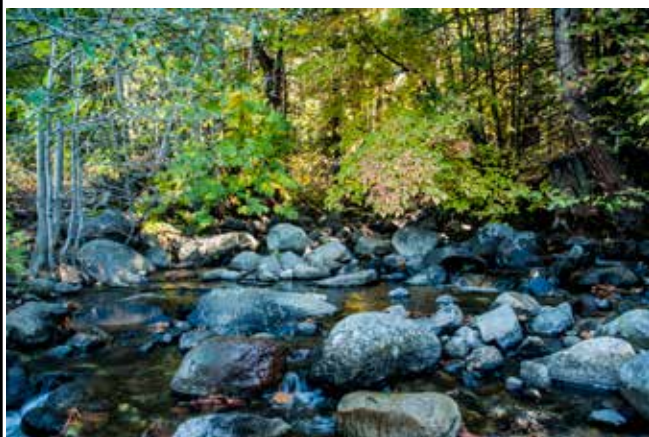
Given the depth of the So. Yuba channel, it is hard to imagine that it was eroded simply by fluvial action (now we are using the geological terms with alacrity).

**Ah, but was it really Piracy?**

Studying the maps and the geography brings up a good question. Was it really “piracy” or “decapitation”? Did the Yuba actually steal the headwaters of the Bear? It is very clear that the two rivers were not eroding towards each other in a classic “capture.” One can

Above: looking west from the diversion point showing the “lump” that was not eroded and which prevented the Bear River from continuing on its traditional route as the new course was eroded.

Below: current headwaters of the Bear - clearly not enough to have eroded Bear Valley into its current configuration.



see that from the maps and from on site exploration. Much as it hurts, having gotten into this imagining the success of headlines, “Yuba Pirates the Bear Headwaters” or something like that, there was no decapitation. There was no piracy. The Bear, coming into Bear Valley, ran into some harder rock. It, like people, which shows what a sensible river it is, took the path of least resistance. It went northwest and worked its way to Canyon Creek. On the way it joined the outflow of a couple of other streams so it did not even have to make its new course from scratch the whole way.



Above: small scene in one of the tributaries that feeds the source of the current Bear River.

This same argument holds true for the glaciers, which in James’ mind really did the deed. It was glaciers coming down the drainage which is now Lake Spaulding and the Bear Valley that hit the bedrock. Some of the glacial action was diverted northwest and carved out what is now called the So. Yuba Gorge.

So the real issue here is how the rivers were named. There was no Board of Geographical Names in the really old ice age days. The first white people simply named things wrongly. The Bear River today starts on the flank above Summit Valley and gets to Bear Valley where it turns northwest. When the river made the turn, it simply changed course, as rivers do. As it continued, it joined a stream/river that should have been called the So. Yuba instead of Canyon Creek. At the confluence the river might have been named So. Fork of the Yuba or Bear River – depending on who supplied the most flow (probably the Bear). What is now called the So. Fork of the Yuba on Donner Summit should really be the Bear River.

**Despite Nature’s Efforts... - Irony**

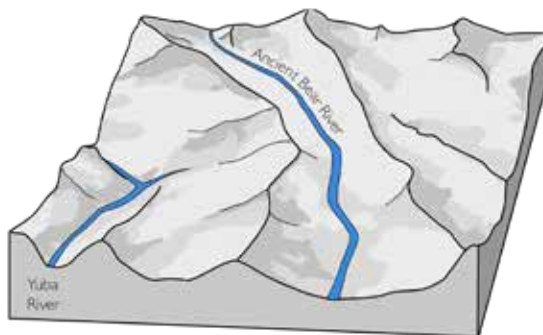
Then there is a final issue. It’s an irony noted by eminent MHRT member, Art Clark (see our Then and Now’s on our website or in old Heirloom issues - see the indices). The Bear changed course or had its headwaters stolen and the water headed down the So. Yuba Gorge, met Canyon Creek and continued on its merry way. That’s what geologists say. When the White men came they started building canals. They interrupted the flow of So. Yuba and put it into various canals. Those first canals took water that was to flow down the So. Yuba and put it back into the Bear to do hydraulic mining. When the State Supreme Court outlawed hydraulic mining in the 1880’s, the water was turned to irrigation use in the Central Valley and to supply municipal needs. Then along came electricity. The water that should be in the So. Fork of Yuba, leaves Spaulding and heads down Bear Valley – just as it did thousands of years ago before the ice ages. The Bear has reclaimed its water, thanks to the arrival of “civilization.” So maybe the headlines should be, “Plucky River Reclaims its Water.”

Today there are two canals taking water from the So. Yuba and putting it back into the Bear River channels to operate a number of power plants. The Bear has gotten its water back.

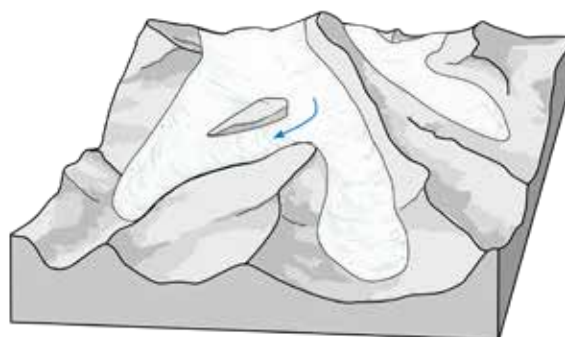


## The Yuba River Captures the Bear

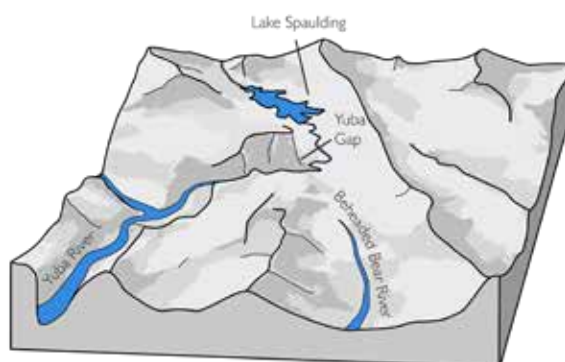
Drawing is courtesy of Emily Underwood, Underwood Illustrations: [http://underwoodillustration.com/artwork/3108999\\_Stream\\_Capture.html](http://underwoodillustration.com/artwork/3108999_Stream_Capture.html)



**1** The Bear River was once a much larger river with a larger contributing area. The Yuba was only a small tributary separated from the Bear River by a low divide.



**2** A series of glacial advances ground through the narrow ridge separating the Bear and Yuba drainages. The erosive power of ice and water carved out a deep gorge and lowered the base level. The stream changed course.



**3** Today, the water that once flowed down the Bear Valley flows down the Yuba. The Bear River is a classic example of an *underfit stream* or *beheaded river*, flowing through a valley that was originally carved by a much larger waterway.

### Bibliography

“Diversion of the Upper Bear: Glacial diffluence and Quaternary erosion, Sierra Nevada, California,” L. Allan James (1)

“Late Pleistocene Glaciations in the Northwestern Sierra Nevada” James (2)

Assembling California

Journal of Electricity Power and Gas “Lake Spaulding - Drum Power Development” (December, 1913)

field visits

USGS Topographical Maps

<http://bearriver.us/geology.php>

<http://bearriver.us/docs/geomorph.pdf>

## Sidebars

### Want to Visit the Piracy or Decapitation?

Head along I-80 to the Highway 20 turnoff and go the only way you can go, north towards Nevada City. After leaving I-80 you will go to the bottom of Bear Valley. On the right, a couple of miles down is the turn off to Bowman Rd. and the PGE Discovery Park.

Turn off the highway and proceed to the park's parking lot. There you can park and walk east or you can continue on the road east.

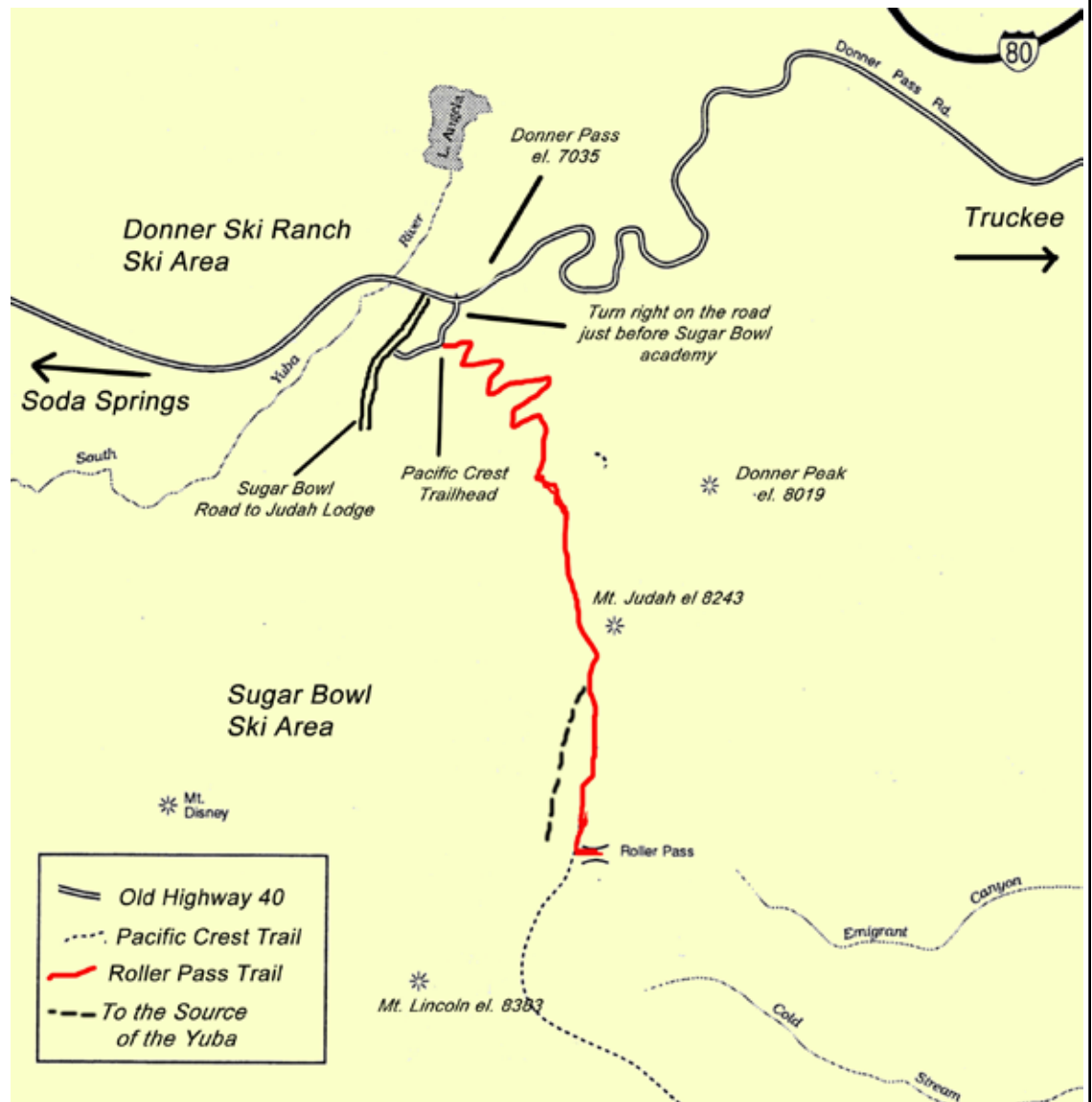
The PGE park offers bathrooms and an easy trail which crosses the Bear River and then makes a self-guided loop, including a small waterfall.

One can then continue driving north, crossing the South Yuba Canal which carries water from Lake Spaulding. The road descends down to a bridge across the South Yuba River. Park just across the bridge. Another trail leads to several nice spots along the river. If you have lots of energy, you can continue up for several miles and get a good view of Lake Spaulding.

### Want to Visit the Source of the Yuba on Donner Summit?

Take the Pacific Crest Trail south from Donner Pass, just off the Lake Mary Rd. You will go about 1 ¼ miles on the trail going under one ski lift (Mt. Judah Lift). When you get to the second lift, the Jerome Hill Lift, the trail takes a sharp left turn. You will not go under the second lift. As you get past some thick bushes where the trail makes the sharp left, where you see the Jerome Hill Lift off a bit to the right, you leave the trail going right. Stay on that contour for about a quarter mile. You will come to a meadow and in the upper middle of the meadow you will come to the source of the Yuba (page 3). You can't miss it if you go to the most verdant area.

The dashed line here shows the route to take when you leave the PCT just after the Jerome Hill chairlift.





Above left: glacial till alongside the So. Fork of the Yuba and across the river from the picture below left.

Below: Limestone formations along the So. Fork of the Yuba after it emerges from Lake Spaulding.



Above and right: the lower So. Fork of the Yuba River above the confluence with Canyon Creek.

Right: Confluence of the So. Fork of the Yuba and Canyon Creek.



Left: looking up Canyon Creek at the confluence with the So. Fork of the Yuba.



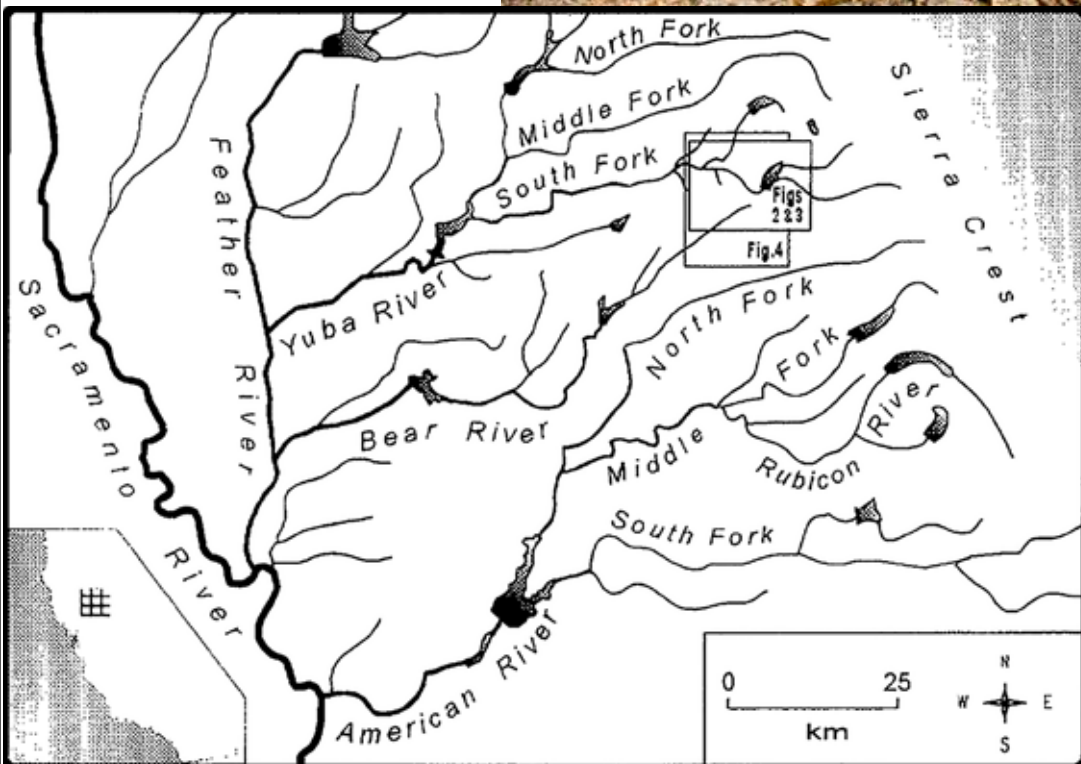
Right: So. Fork of the Yuba River Gorge a few miles northwest of the diversion site and a few miles northeast of the confluence with the Canyon Creek. This is taken west of the Jolly Boy Mine and west of the townsite of Maybert. The ridge top in the distance is 2400 feet above the riverbed.





Hole eroded in granite by the river. That's MHRT member Art Clark's shoulder.

Below, glacial erratics spread across the land near the rivers.



Simple map. The squares show the South Fork of the Yuba and just south, is the Bear River.

# From the DSHS Archives

## House of Vanderford



Last month we ran three pictures of Vanderford's lodge which used to sit opposite what is now Donner Ski Ranch. The House of Vanderford run by "Ma" Vanderford, was part of a different culture on Donner Summit. The highway ran right past the front door making Donner Summit easily accessible. People came up to enjoy what the summit has to offer and lived communally rather than as they do today, in separate hotel rooms or separately rented cabins. People ate together, shared chores in some lodges, and did not mind sleeping in dormitories. Vanderford's offered both dormitory space and rooms. After skiing there were group activities: ski movies, games, singing, dancing, and imbibing. You can see the lodge in the photograph above, in the lower right. Van's Grocery Store is the next building to the left.

Jessie Vandeford came from Sacramento and bought the land that would become Vanderford's in 1939. She ran a kids camp at Vanderford's in the summer and had a ski school in winter. The building burned down in 1946 or 1947.

# From the DSHS Archives



Above, House of Vanderford, 1940. The dark part to the right is the original building. Left, undated picture.

HOUSE OF VANDERFORD  
— Guest Card —

Name Miss Violet Hansen

Arrival 7/27/41 Room No. K-1

Departure \_\_\_\_\_

No. In Party \_\_\_\_\_



Above: Vanderford's living room. On the back: Sunken fireplace Lobby Living room old part of Vanderfords. Carpet was brought from Mormon church in Utah!

Lower picture: communal family style dining at Vanderford's. Out the window is the view of the snowsheds.





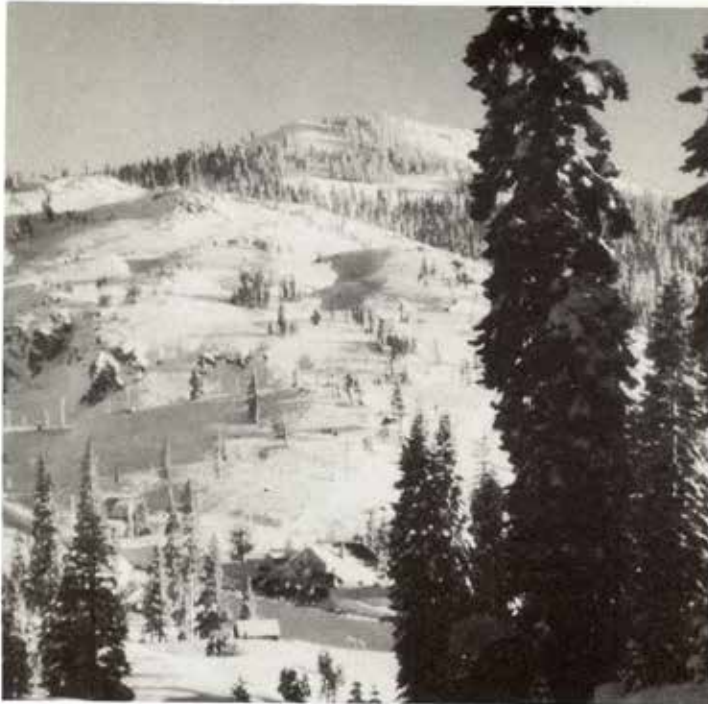
# HOUSE OF VANDERFORD

**Location:** Elevation: House of Vanderford is located "atop the Sierra" at Donner Summit—about one and a half miles from Norden Ski Hut. Transportation between Norden Skit Hut and House of Vanderford provided by station wagon—no charge for guests. Representative meets trains.

**Skiing Facilities:** Many good ski trails near resort. Two new rope tows have been installed on Signal Hill. Nearby is Johnny Ellis' Ski Tow, the Sugar Bowl and the Sierra Club which has a rope tow. Rates are comparable to other tows in the area.

House of Vanderford Ski School charges \$2 per session, 12 lessons \$12.

**Sleeping Accommodations:** New dormitories and new lounge installed this year. Rates per day, American plan (with meals): \$3.25 in dormitories; \$3.50 per person in double rooms without bath. Weekly rates:



*Atop Donner Summit is the House of Vanderford.*

\$19.50, dormitories; \$21 per person, double rooms. Rates for guests furnishing own sleeping bag: \$3 per person, \$18 per week.

**Reservations:** Write, wire or phone (Vanderfords via Truckee) Mrs. J. A. Vanderford or Bill Strickland, House of Vanderford, Norden, Calif.; 740 Market Street, San Francisco (DOuglas 6677), or H. C. Capwell Travel Bureau, Oakland (TEmplebar 1111).

Above: from a Vanderford's brochure

# Pat's Reminiscence



Last month we ran a few pictures of Vanderford's and Van's Grocery on Donner Summit that was right next door. Knowing that long time Lake Mary resident Pat Malberg must have visited the now long gone store, we solicited her memories. Attentive readers have noted that Pat is the proof reader of this fine publication, which of course helps in making it fine.

No. What I remember is a little store — at least that's where I could buy milk, bread and eggs, and in the same building, but with a separate entrance, was a cafe with coin-operated juke boxes at each table. The latter fascinated me when I was little, and couples would get up and dance sometimes. I think the wife's name was Margo, or something like that, and they had a son who was a couple of years younger than I, and a real live-wire. If I remember correctly, they moved to Central America, but all of this is very vague, as I was really young. I wish my Mom were still around — she'd have some good stories to tell.

I walked from the cabin to the little store with my 25 cents, through the covered passageway leading to the railroad snow shed, which also served to give covered access to the railroad workers' houses, then crossed the railroad and walked up to buy the bread and milk. I did not linger because I was not supposed to make my Mom worry.

Sorry not to be any more help than that.

Pat

# VANDERFORD'S

HOTEL ACCOMMODATIONS - DINING ROOM - UP-SKI

TELEGRAPH VANDERFORD'S  
NORDEN, CALIF.

RENTAL  
SKI EQUIPMENT

# DONNER SUMMIT SKI LODGE

FRED KLEIN, SKI INSTRUCTOR  
CLASS & PRIVATE



Above and below, Vanderford's, 1941



Bill Klein, Vanderford's ski instructor.



# Book Review

## Roadside Geology of Northern and Central California

David Alt and Donal Hyndman  
2nd Edition, 2016 368 pages

To go along with our "Piracy..." article this month, we have a review of a geology book which exposes really old history.

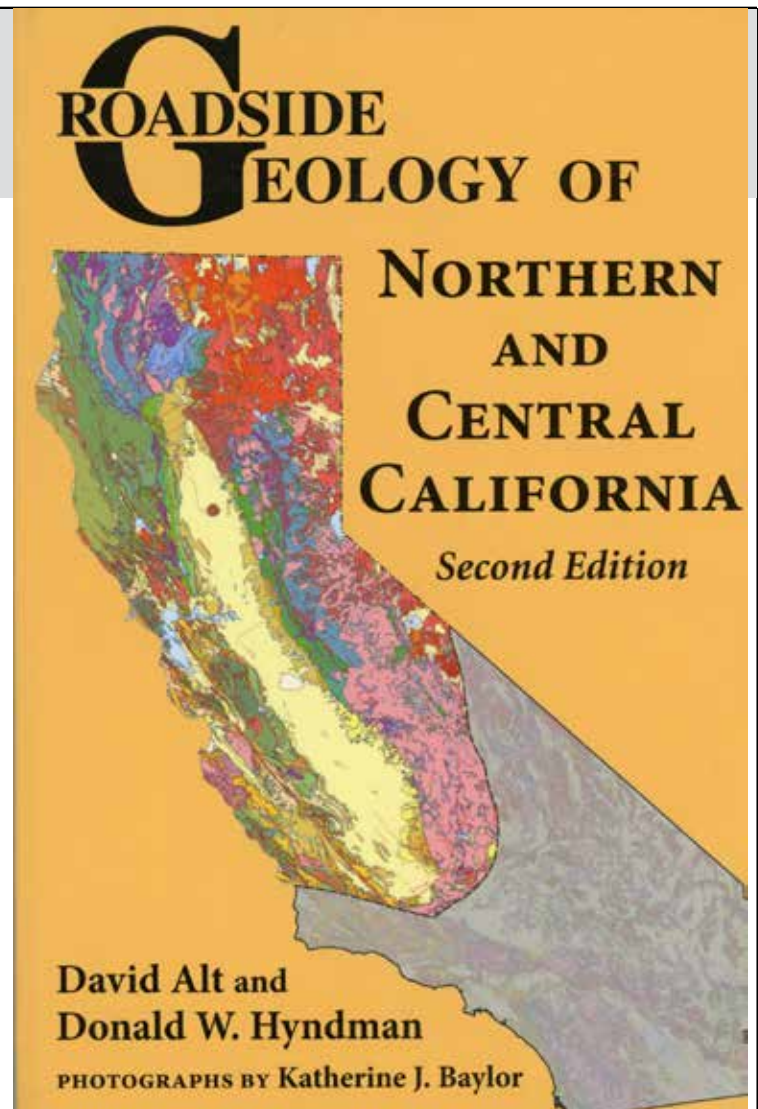
This is an interesting book in itself and more interesting if you go out and take the various geological field trips around California. Most are not relevant to us though, because they are not of Donner Summit. One of the "Roadside Geology" trips in the book is for I-80 up over Donner Summit.

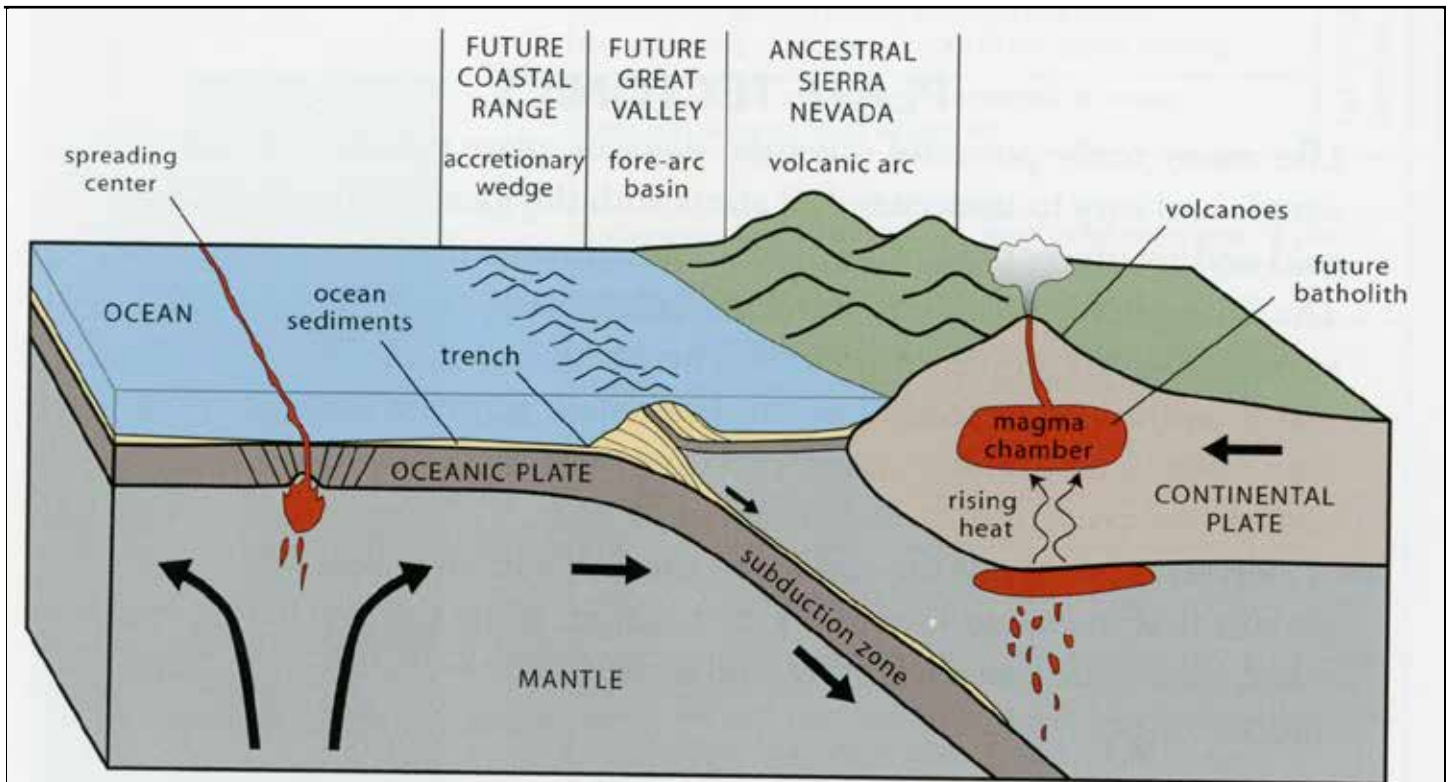
The beginning is general and a good introduction to plate tectonics and general geology of California including gold and glaciation. The second part of the book is seven field trips through various parts of California geology. One of those trips is I-80 from Sacramento to Reno.

"Two hundred million years ago, the western edge of North America was somewhere near the present eastern edge of California. About the same time, North America began moving west, away from the mid-Atlantic oceanic ridge, where the Atlantic Ocean was beginning to grow. The moving continent collided with the floor of the Pacific Ocean, which sank beneath the continent's oncoming western edge, then disappeared into the hot depths of the Earth's mantle. But the sediments and volcanic islands on the oceanic floor were too light to sink. They crumpled in the grinding encounter between continent and ocean floor, to become most of California." As the authors say, that's the big picture. The book goes into some of the details and even delves into the future, "If present trends continue, the slice of California west of the San Andreas fault zone will continue to move north and will part company with the rest of California sometime around 15 million years from now. It should eventually arrive in Alaska."

There is an extensive bibliography for further reading. Here we should say that if you are interested in this subject, the book [Assembling California](#) by John McFee (see our January, '12 [Heirloom](#) or the book review page on our website) is better and can be used as a road guide..

"The word granite is an old miner's term that originally referred to almost any massive granular rock.... A batholith is simply a large expanse of granite, enough to cover more than approximately 40 square miles. That batholith is the Sierra, having risen from the depths." The Pacific tectonic plate is driving under the North American continental plate and the seabed crust is melting. "The released water rises into the overlying mantle, partially melting it to make basalt magma, which in turn rises into the overlying crustal rocks and partially melts them to make granite magma."





*The subduction zone off the coast of California in Cretaceous time.*

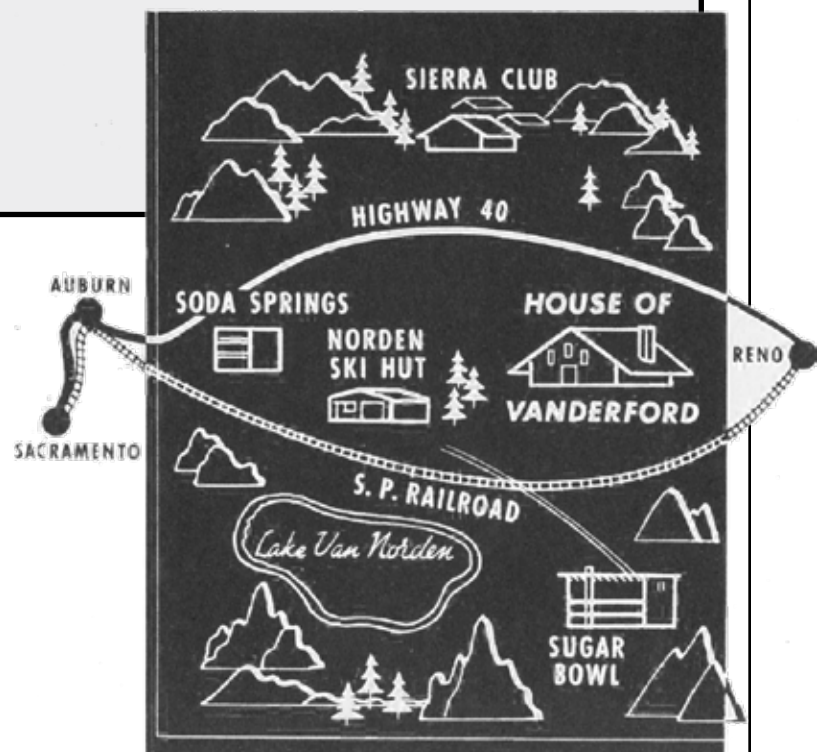
## Note:

You have noticed our monthly book reviews. You might want to do some reading of your own.

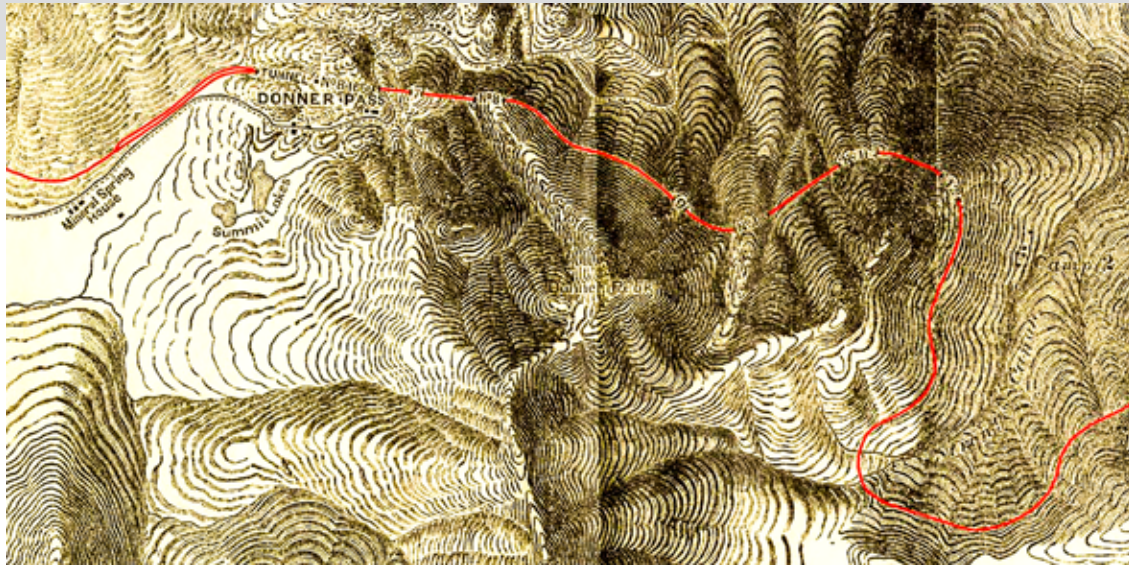
Stop in at the DSHS. Norm Saylor has a large collection of books for perusing, buying, or checking out.

You might even want to do a review for us.

Map from the Vanderford's brochure in case you want go.



# Odds & Ends on Donner Summit



We haven't visited the transcontinental railroad in a long time\* but we were perusing some things in preparation for a coming article when we came across the following in "Tunnels of the Pacific Railroad" from Van Nostrand's Eclectic Engineering Magazine, 1870. Suppose you wanted to build a Tunnel 6 today. Mr. Van Nostrand provides a budget, below.

Just in case you are thinking about building a Tunnel 6, you can use this budget as a starting point for any bank loans.

## Appendix D.

### *Estimated Cost of Excavation in Tunnel No. 6, Central Pacific Railroad (Granite with Powder); average progress, 35' per month.*

#### Cost of each heading and bottom per month :

100 men per day (in 3 shifts).....	at \$31 00	\$3,100 00
2 foremen; pay, \$90; board, \$30.....	" 120 00	240 00
3 horses.....	" 50 00	150 00
3 blacksmiths; pay, \$85; board, \$30.....	" 115 00	345 00
3 helpers; pay, \$50; board, \$30.....	" 80 00	240 00
40 kegs powder.....	" 4 00	160 00
150 lbs. candles.....	" 40	60 00
400 bushels charcoal.....	" 20	80 00
1,500' fuze.....	" 3 00	45 00
Superintendence, tools, etc.....	20 per cent.	884 00
		<hr/>
		\$5,304 00

Or \$14.80, gold, per cubic yard. With nitro-glycerine the cost must have been about \$10 per cubic yard.

Map comes from CPRR.org today and From Vose, Manual for Railroad Engineers in 1883.

Contour Map, Central Pacific Railroad from Summit Valley to the Truckee River by Samuel Montague and Lewis M. Clement.

Railroad route shown in red (color added).

\*to catch up look up "Transcontinental RR," "Tunnel 6," or "Chinese" in our Heirloom indices for many articles, book reviews and lots of pictures about different aspects of the building of the railroad. Our website also has exhibits and brochures about the subject

\*\*\$5304 in 2020 dollars is: \$104,734 and change.

We should note that they build tunnels differently today as the end of our brochure on Tunnel 6 (see our website) notes: "Boring machines are used to bore tunnels [today]. A circular boring machine can bore a tunnel 20' in diameter at a rate of about 50 feet a day. Making Tunnel 6 today would take about a month, rather than the two years it took in 1866-67." So if your tool collection has a boring machine in it, you will make better progress than the above budget sets out. I understand that renting one, though, is very expensive and not all tool rental concerns carry them.

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