Ice Age Floods Institute—Ellensburg Chapter

# Naches River Basin Field Trip


## Field Trip Leaders:


Karl Lillquist, Geography Department, CWU

Nick Zentner, Geology Department, CWU


Sunday 25 September 2011


# Route & Itinerary

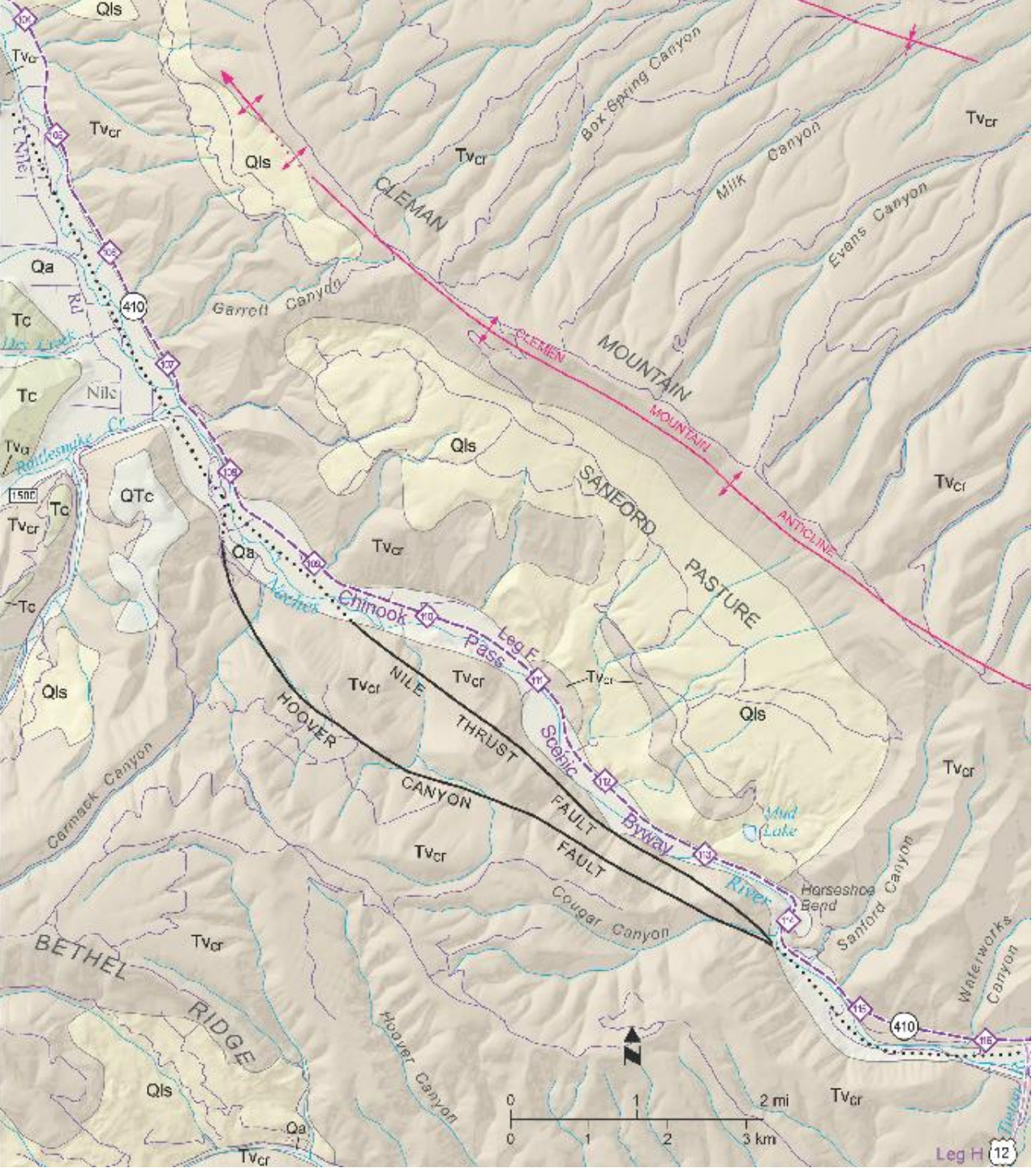
| | |
|---|---|
| 11:00 | Depart from CWU's Hebeler Hall |
| 12:00 | Arrive Stop 1—Sanford Pasture Landslide |
| 12:30 | Depart for Stop 2 |
| 12:45 | Arrive Stop 2—Nile Landslide (up close) |
| 1:45 | Depart for Stop 3 |
| 2:00 | Arrive at Stop 3—Nile Landslide (big picture) |
| 2:30 | Depart for Stop 4 |
| 2:45 | Arrive at Stop 4—Edgar Rock Volcano |
| 3:15 | Depart for Stop 5 |
| 3:30 | Arrive at Stop 5—Boulder Cave |
| 4:30 | Depart for Ellensburg |
| 6:00 | Arrive in Ellensburg |

# Trip Overview

Our field trip will take us from the Columbia Plateau to the South Cascades. Our story begins with volcanism—effusive and explosive that resulted in lava flows, lahars, dikes, and stratovolcanoes. Over time, weathering as well as erosion by glaciers, rivers, and landslides have shaped the volcanics. Recent landslides and floods have dramatically altered this area. Stops will include the early Pleistocene? Sanford Pasture landslide, the October 2009 Nile Valley landslide, Miocene Edgar Rock Volcano, and Quaternary Boulder Cave–all in the middle Naches River Valley.

# Enroute to Stop 1

- On I-82, we go over three prominent NW-SE trending up-folds or *anticlines*—Manastash Ridge, North Umtanum Ridge, and South Umtanum Ridge. These folds, and some associated thrust faulting, are the result of ~N-S compression.
- If the weather is clear, note Mount Rainier and Mount Adams, the towering stratovolcanoes that dominate the South Cascades. Their impacts on this area are primarily aesthetic and climatological rather than geologic—i.e., neither shed lahars or lava flows that reached any parts of today's trip.
- Note the layers of Wanapum Basalts of the Columbia River Basalt Group exposed in lower Selah Creek Canyon. This was the site of one of the stops on Nick's April 2011 IAFI field trip.
- We pass through a "water gap" in a fourth ridge —Yakima Ridge—just prior to turning west onto US 12. These ridges are all part of the Yakima Fold and Thrust Belt. Look for folded and faulted basalt flows and associated sedimentary interbeds supporting this tectonic origin for these ridges.
- The maximum level of Missoula Flood slackwater reached at least the floor of this water gap at 1050 ft elevation. Crystalline rocks exposed upstream at the mouth of Wenas Creek may indicate Missoula Flood deposits or may be more locally derived.
- On US 12, the prominent ~E-W trending ridge on our left is the Tieton Andesite, a 1.6 My old andesite flow that originated at the Goat Rocks volcano. At 49 miles long, this is thought to be the world's longest lava flow (Swanson, 1990). This flow was the site of one of Nick's stops on the Ellensburg Chapter's April 2011 field trip.
- The white, near-horizontal layers to the north (right) of the highway are the Ellensburg Formation. The volcanic mudflow (i.e. lahar) and stream worked sediments that originated between ~7-13.3 Ma.
- Cleman Mountain anticline, the highest anticline of the Yakima Fold and Thrust Belt, forms the (nearly 2000 feet of amplitude). This anticline, like the ridges we passed through earlier, has achieved its relief from a complex history of folding as well as thrust faulting.

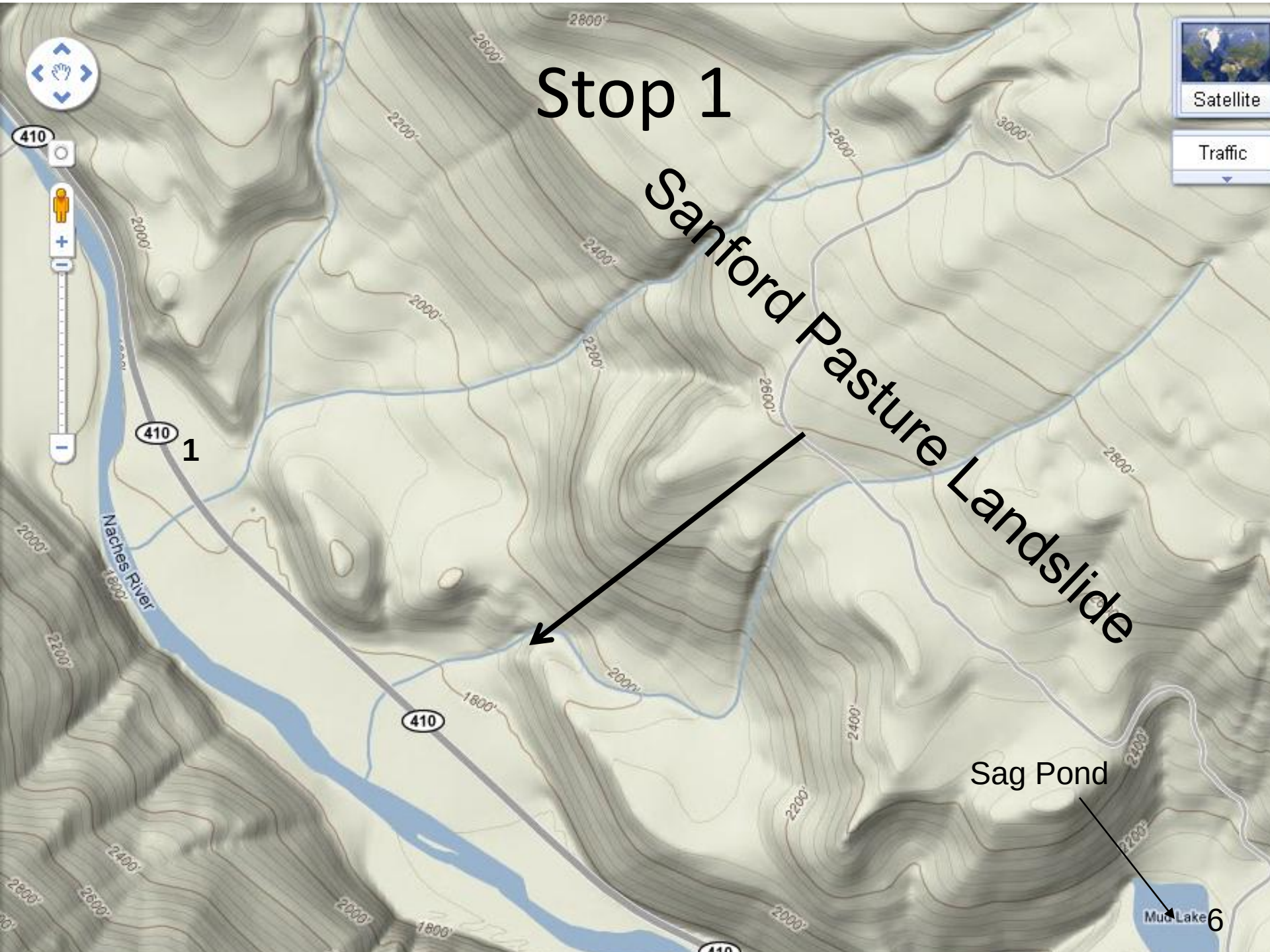



**Geologic units include:**

- Tvcr =Columbia River Basalt
- Qa = Quaternary alluvium
- Qls = Quaternary landslide
- Tc = Tertiary sedimentary

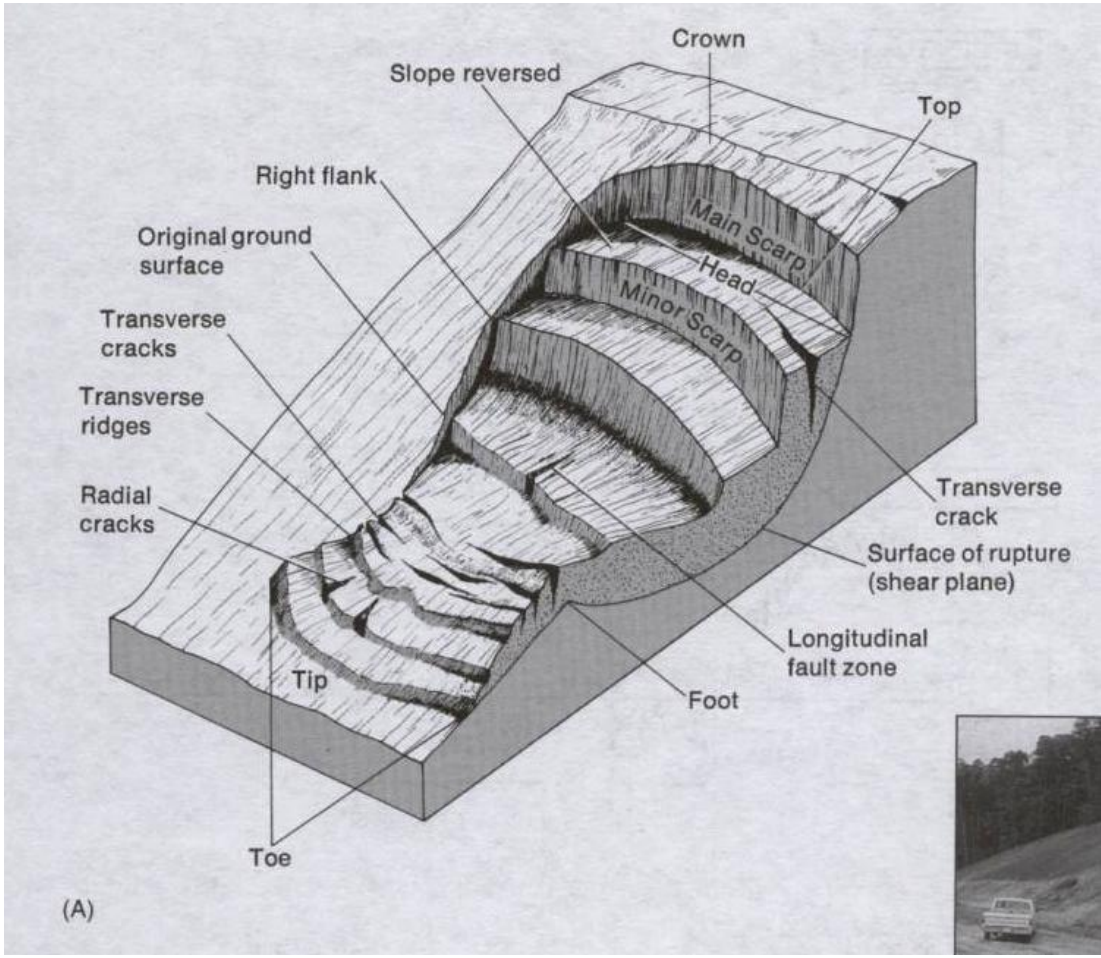
(From Pringle, 2008, p. 108)


Stops 1, 2, & 3
Satellite
Traffic
Cleman Mountain
Nile
3
2
1
410
Naches River


Stop 1
Sanford Pasture Landslide
Sag Pond
Satellite
Traffic
410
1
Naches River
Mud Lake
6

# Stop 1

- Naches River Watershed
- CRB's
- Sanford Pasture Landslide
- Components of landslides
- Impacts of landslides



# Stops 2 & 3


**Nile Valley Landslide Facts**:
-11 October 2009
- 0.5 mile across—2nd largest landslide in WA human history
- Rotational slide
- Causes?
- Implications


# Stop 2

Images courtesy of Jack & Lorraine Powell, WA DNR



WASHINGTON STATE DEPARTMENT OF
Natural Resources

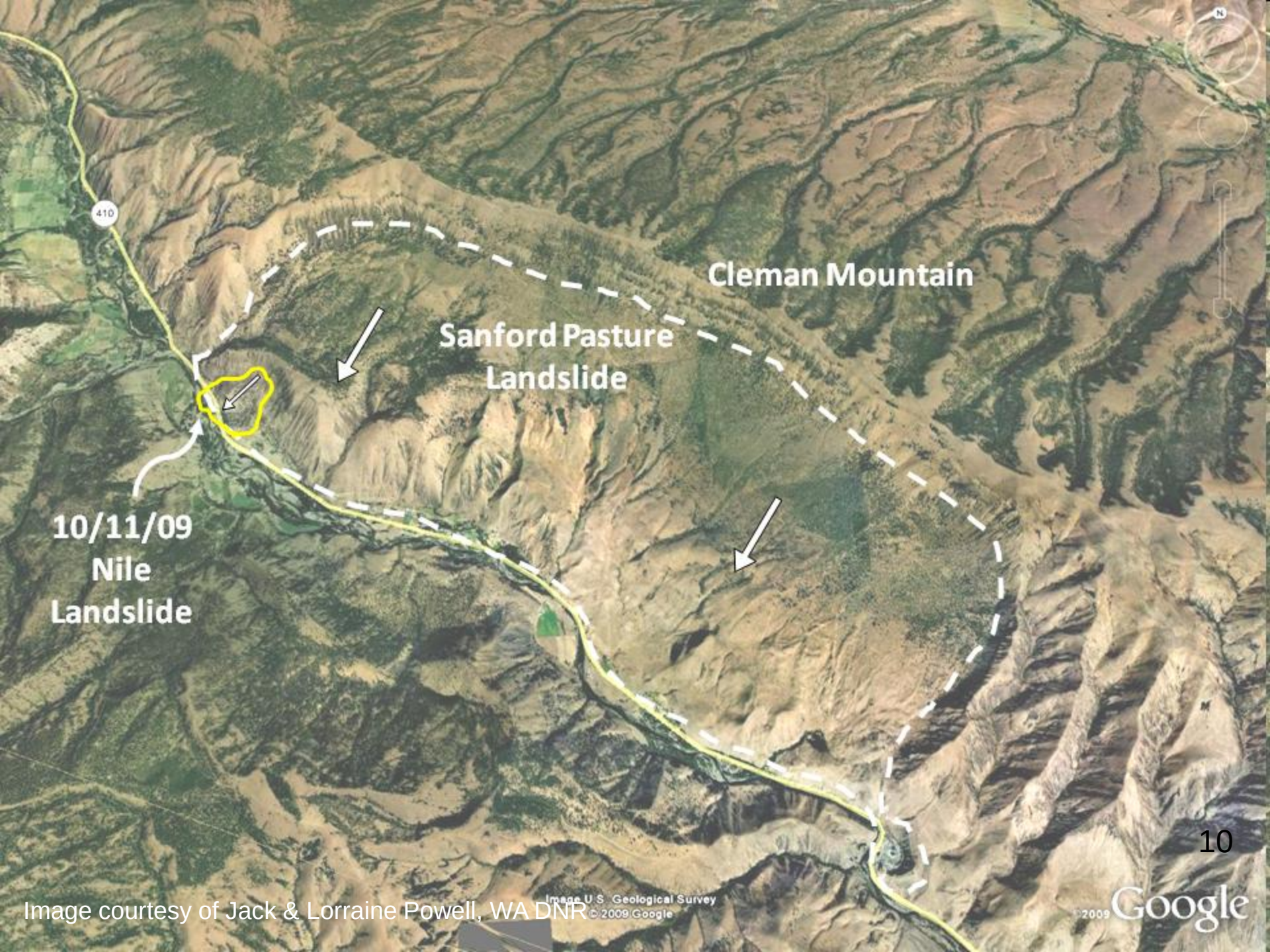
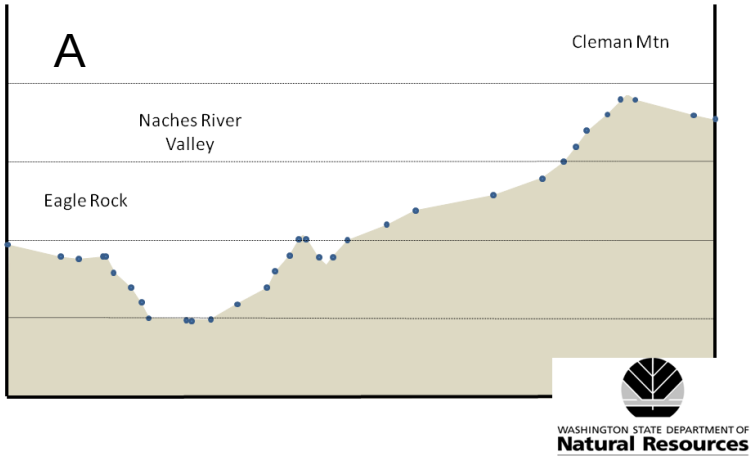




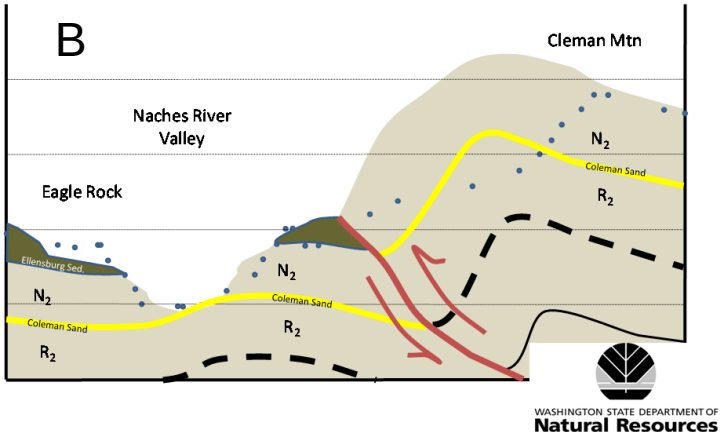

Image courtesy of Jack & Lorraine Powell, WA DNR

# Nile Landslide

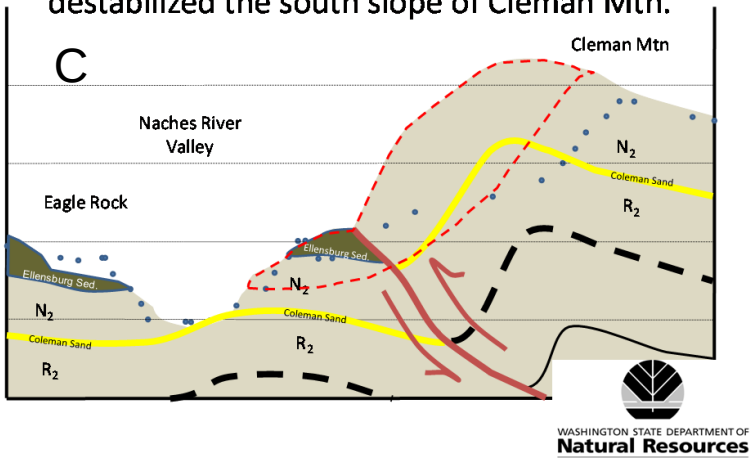
Present Profile from Cleman Mtn to Eagle Rock just prior to the 2009 Nile Landslide



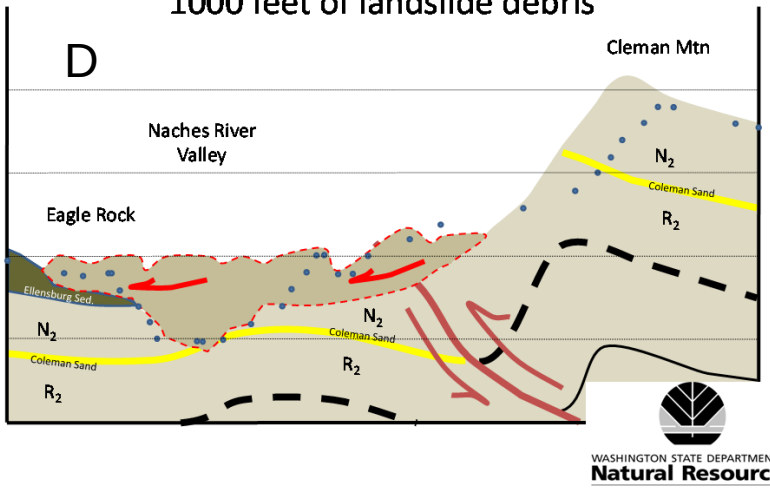

Profile from Cleman Mtn to Eagle Rock Two Million Years Ago




Two Million Years ago folding of the earth and undercutting by the ancestral Naches River destabilized the south slope of Cleman Mtn.



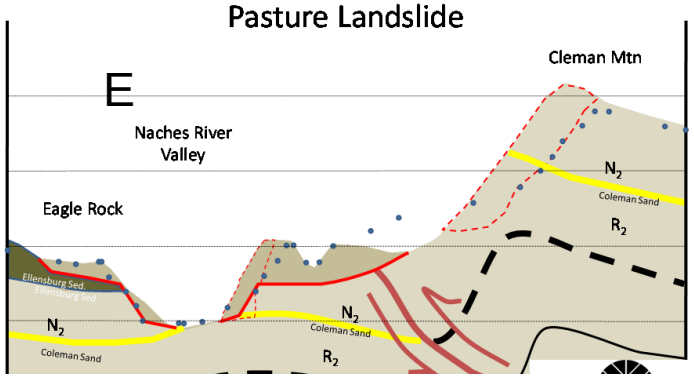

Two Million Years ago the Sanford Pasture Landslide filled the Naches River Valley with 1000 feet of landslide debris



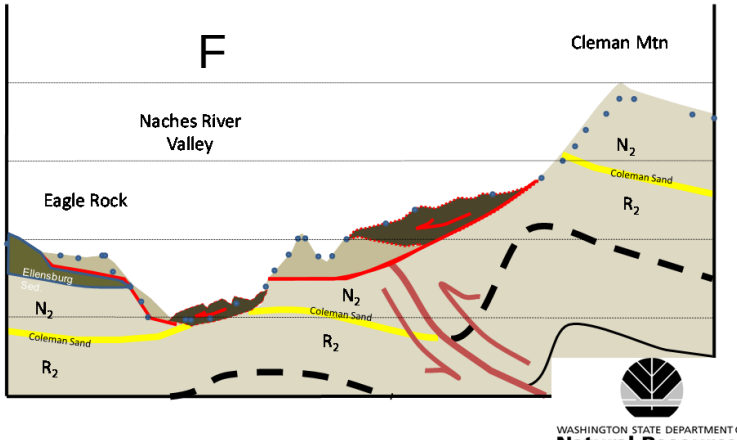

Images courtesy of Jack & Lorraine Powell, WA DNR

# Nile Landslide

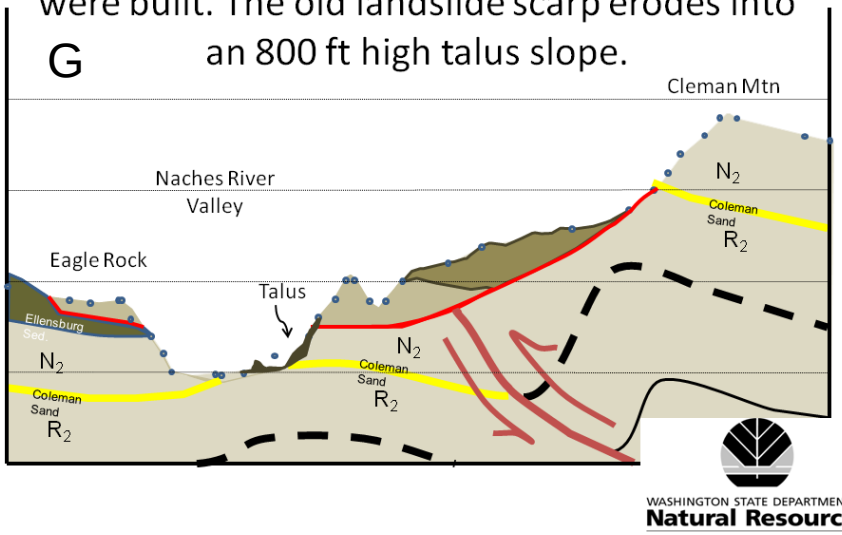
Under cutting by the Naches River over time destabilized the eroded edge of the Sanford Pasture Landslide



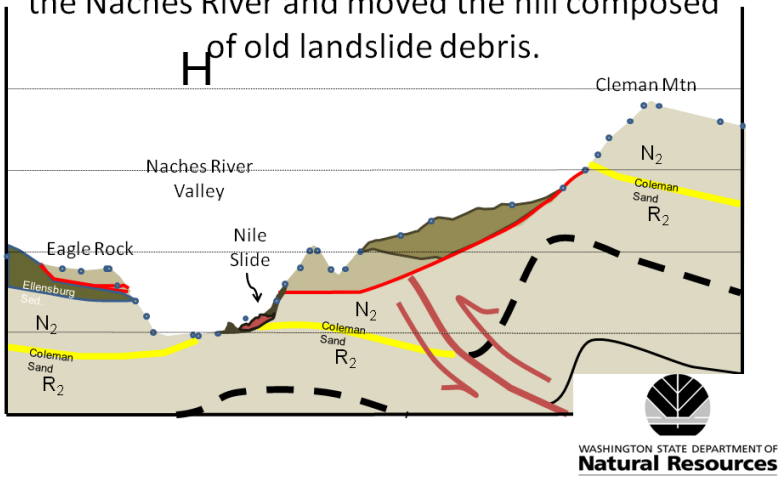

Thousands of years ago a landslide blocked the Naches River valley with 100's of feet of debris



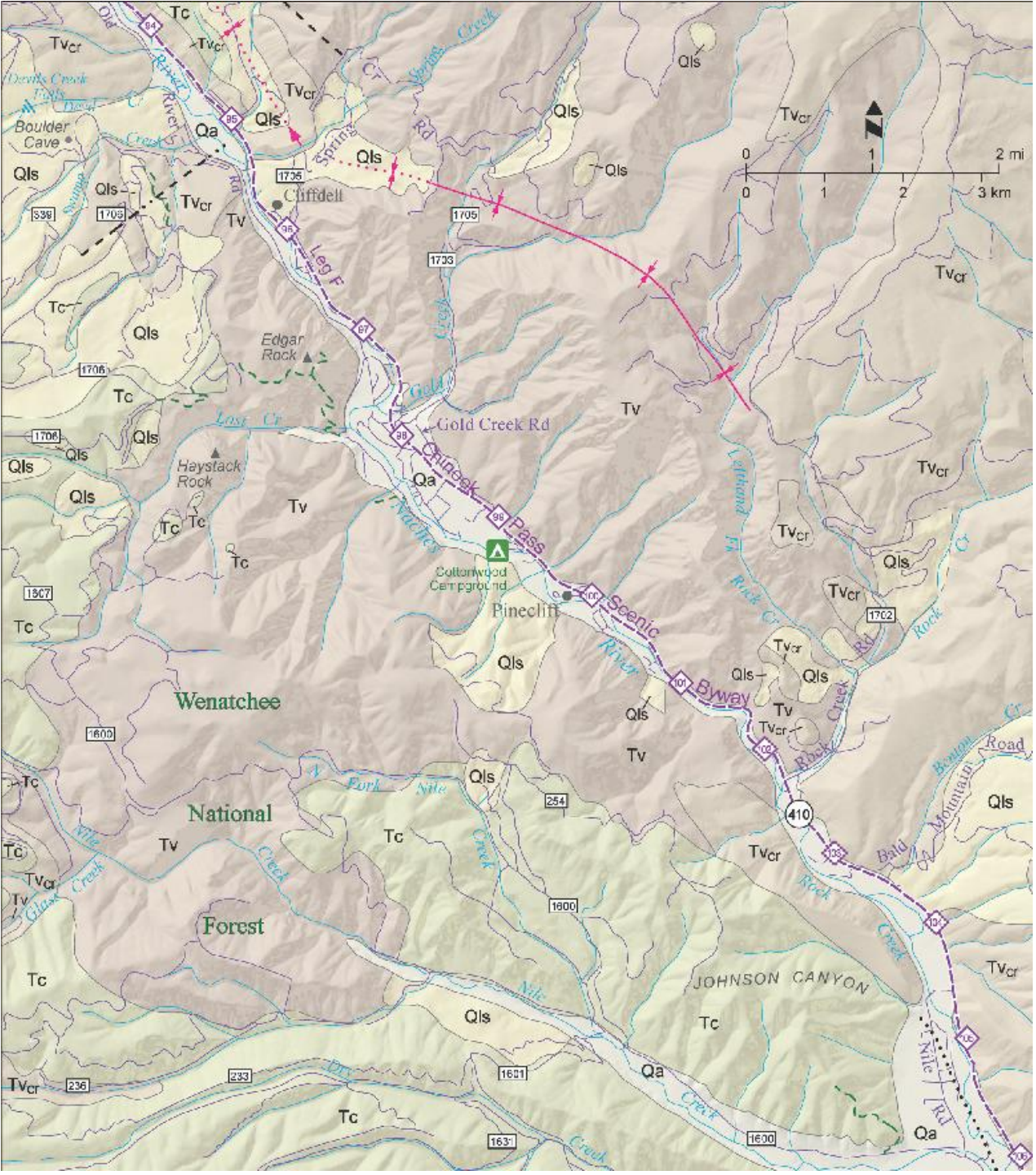

This landslide from thousands of years ago was largely erode away leaving a hill were homes were built. The old landslide scarp erodes into an 800 ft high talus slope.




October 11, 2009 the talus slope, which had been cracking since 2005, slides. Debris blocked the Naches River and moved the hill composed of old landslide debris.




Images courtesy of Jack & Lorraine Powell, WA DNR




**Geologic units include:**

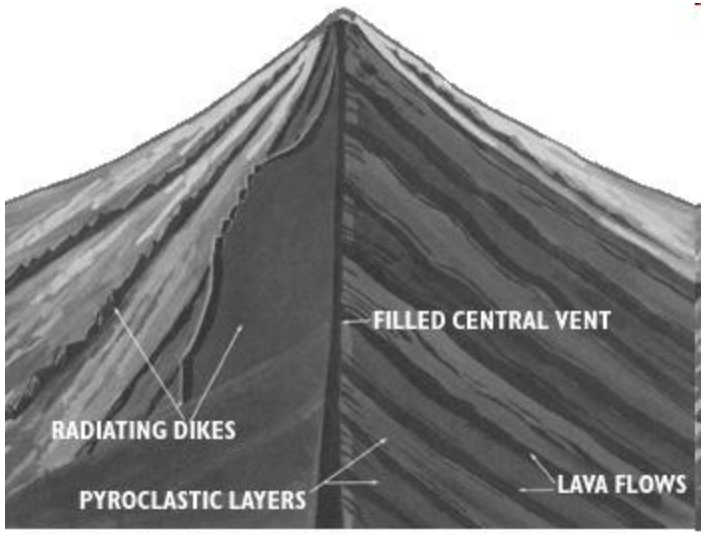
- Qa = Quaternary alluvium
- Qls = Quaternary landslide
- Tvcr =Columbia River Basalt
- Tc = Tertiary sedimentary
- Tv = Tertiary volcanics

(From Pringle, 2008, p. 111)


Stop 4—Edgar Rock
Edgar Rock
Satellite
Traffic
Haystack Rock
Nat for Dev Rd 1791
Old River Rd
Fontaine Ln
Nat for Dev Rd 1703
Gold Creek Rd
Jefferson Rd
Nat for Dev Rd 311
Naches River
410
4

# Stop 4—Edgar Rock Volcano

- Edgar Rock Volcano
  - We are near core of Miocene-age (~26 My) stratovolcano
  - Andesite composition
  - Evidence for old volcano
  - Cone exceeded 10,000 ft elevation?!
  - Edgar Rock as remnant of volcano




*Schematic representation of a stratovolcano. From USGS publication "Volcanoes"*

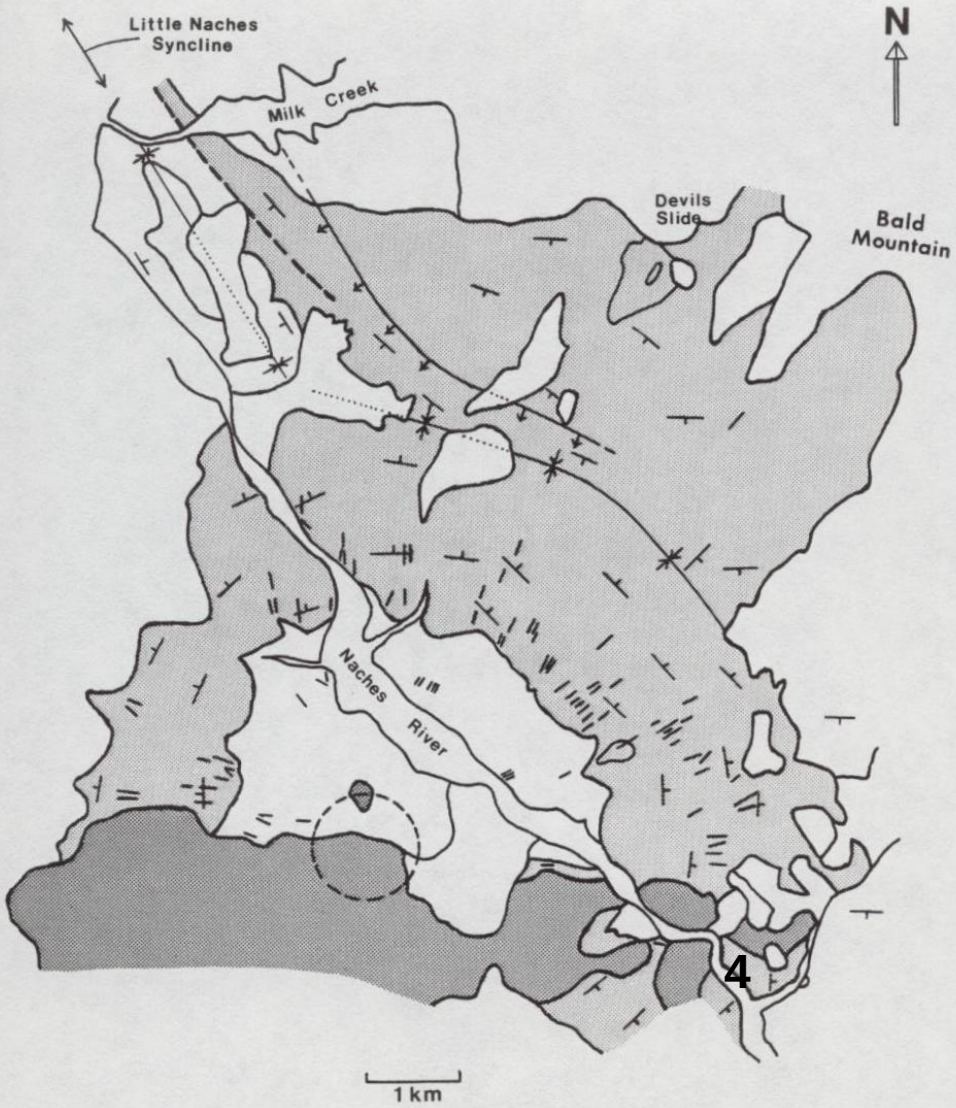
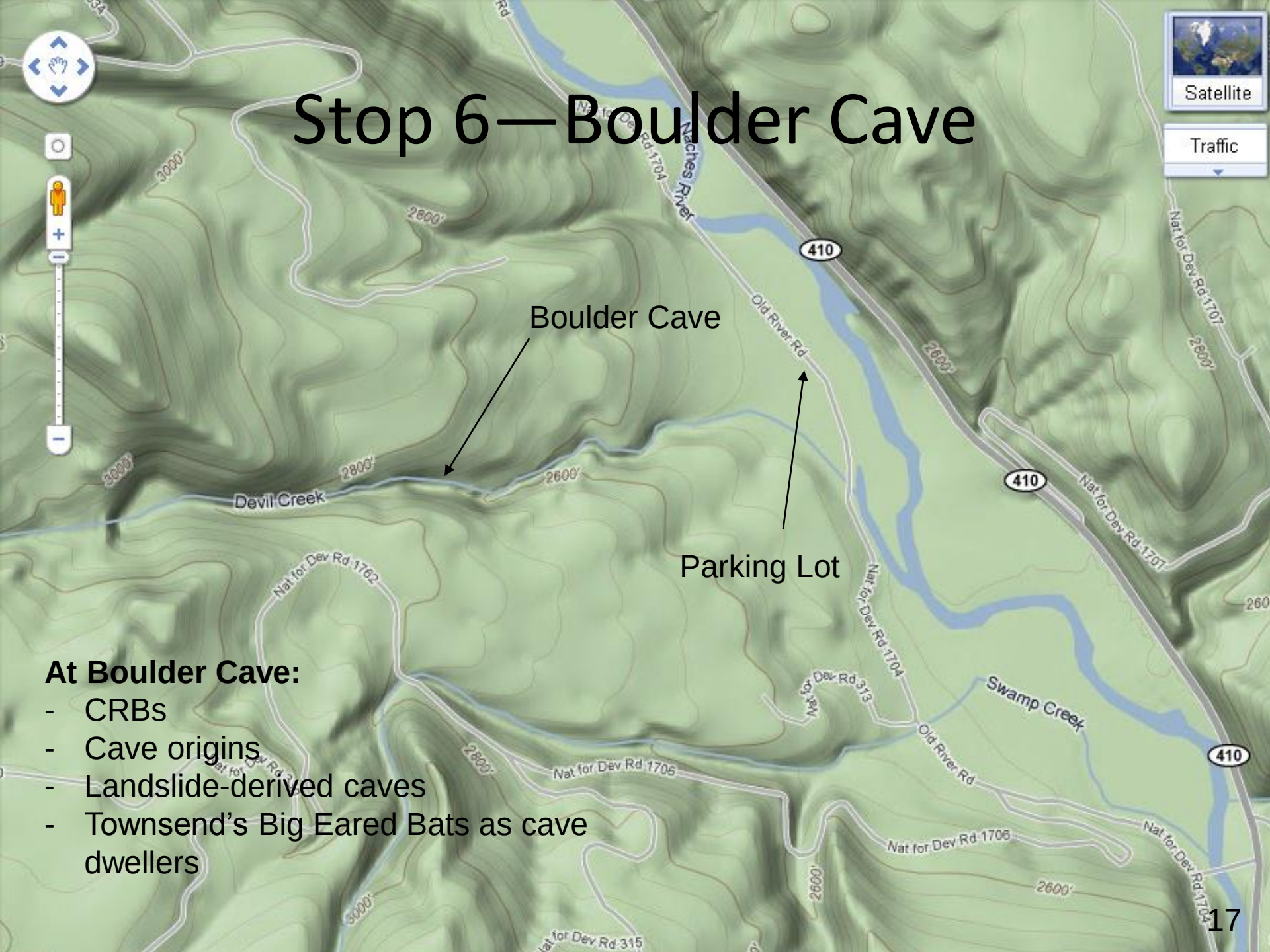



Figure 22. Simplified geologic and structural map of the Fifes Peak Formation in the Cliffdell area. Light stipple is the Edgar Rock member; dark stipple is the Nile Creek member. Short dashes are dikes of the radial dike system. Dashed circle is the focus of the radial dike system.

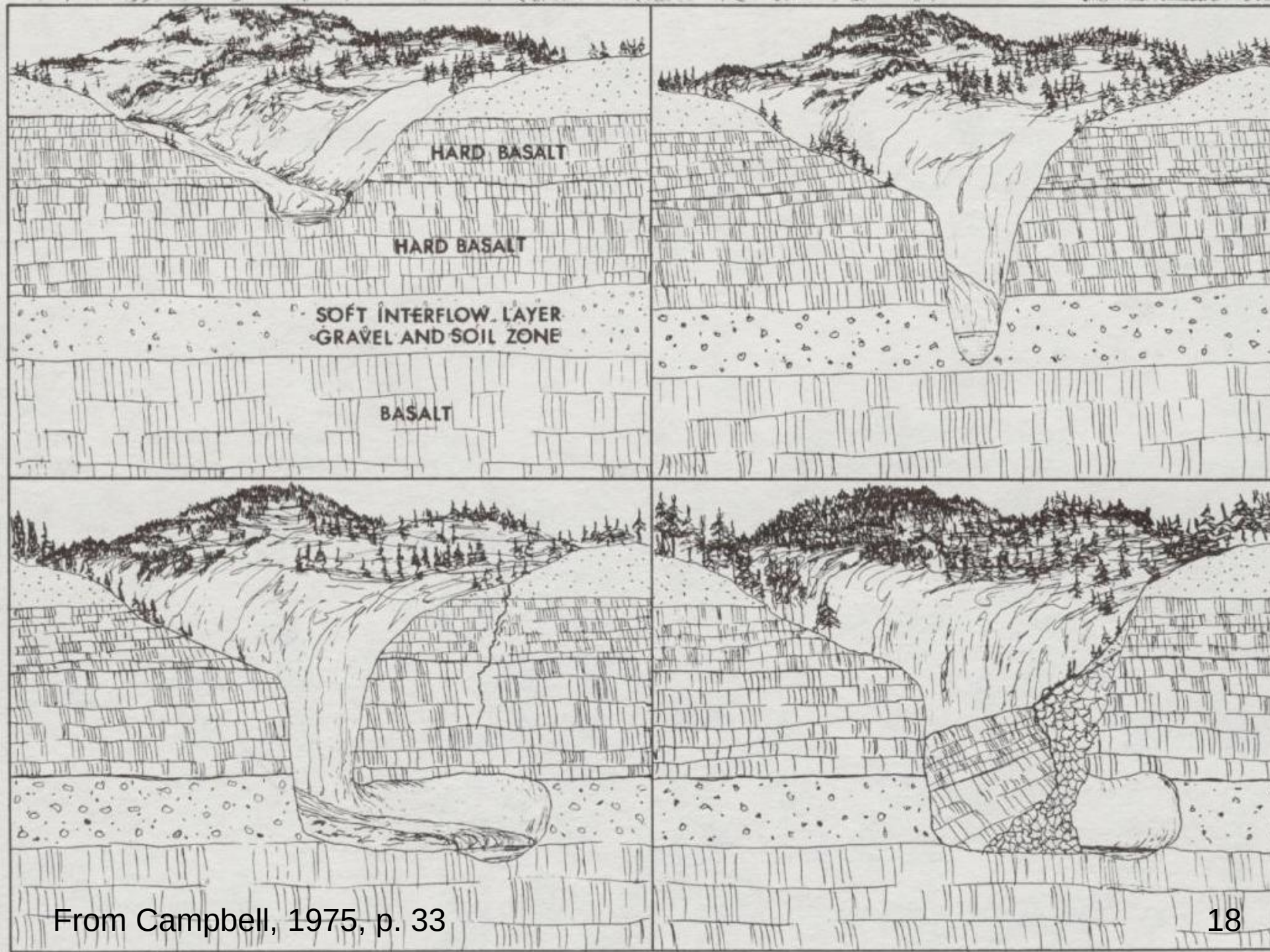
(From Carkin, 1988, p. 62)

# Stop 6—Boulder Cave




**At Boulder Cave:**

- CRBs
- Cave origins
- Landslide-derived caves
- Townsend's Big Eared Bats as cave dwellers




From Campbell, 1975, p. 33

# Useful References


- Badger, T.C., E.L. Smith and S.M. Lowell. 2011. Failure mechanics of the Nile Valley landslide, Yakima County, Washington. *Environmental and Engineering Geoscience Journal* (in press)

- Campbell, N.P. 1975. A Geologic road log over Chinook, White Pass, and Ellensburg to Yakima Highways. *Washington Division of Geology and Earth Resources Information Circular 54*.

- Carkin, B.A. 1988. The Geology and Petrology of the Fifes Peak Formation in the Cliffdell Area, Central Cascades, Washington. M.S. Thesis, Western Washington University.

- Pringle, P.T. 2008. Roadside Geology of Mount Rainier National Park and Vicinity. *Washington Division of Geology and Earth Resources Information Circular 107*.

- Swanson, D.A. 1990. Volcanoes of Washington—Goat Rocks, Washington, In C.A. Wood, C.A. and J. Kienle, editors, *Volcanoes of North America—United States and Canada*. Cambridge University Press, New York. P. 160-161.