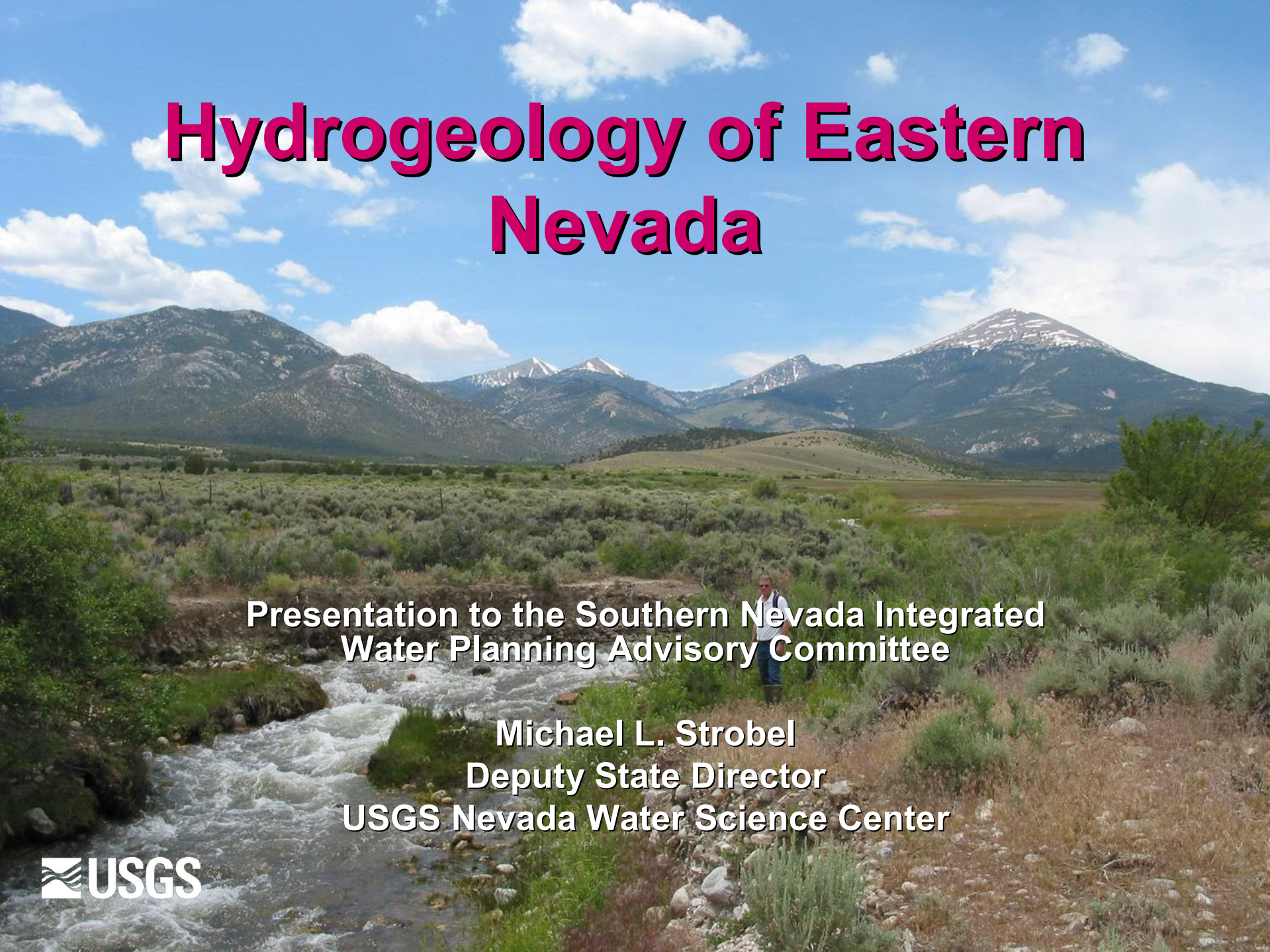
Hydrogeology of Eastern Nevada



Presentation to the Southern Nevada Integrated Water Planning Advisory Committee

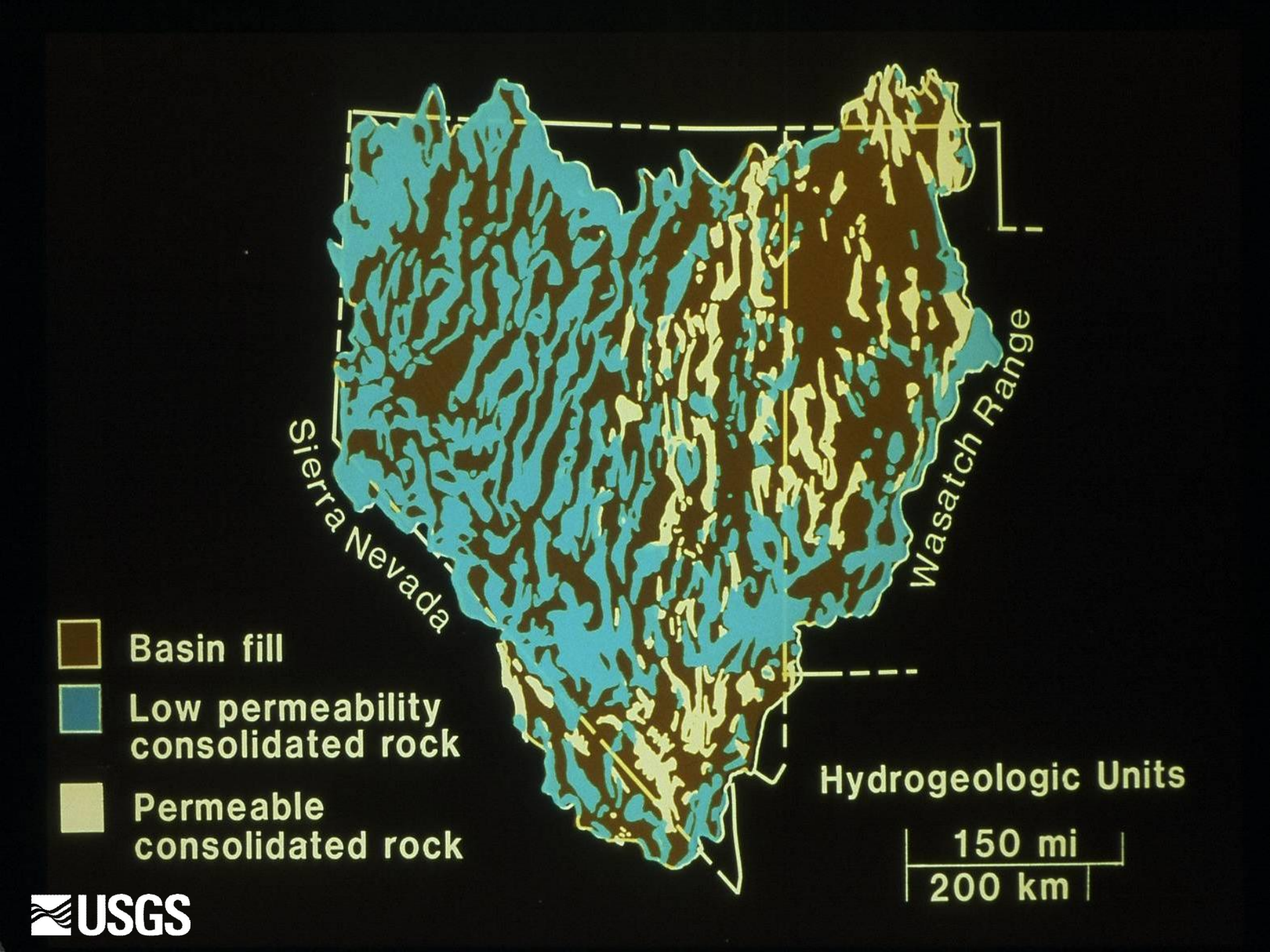
Michael L. Strobel
Deputy State Director
USGS Nevada Water Science Center

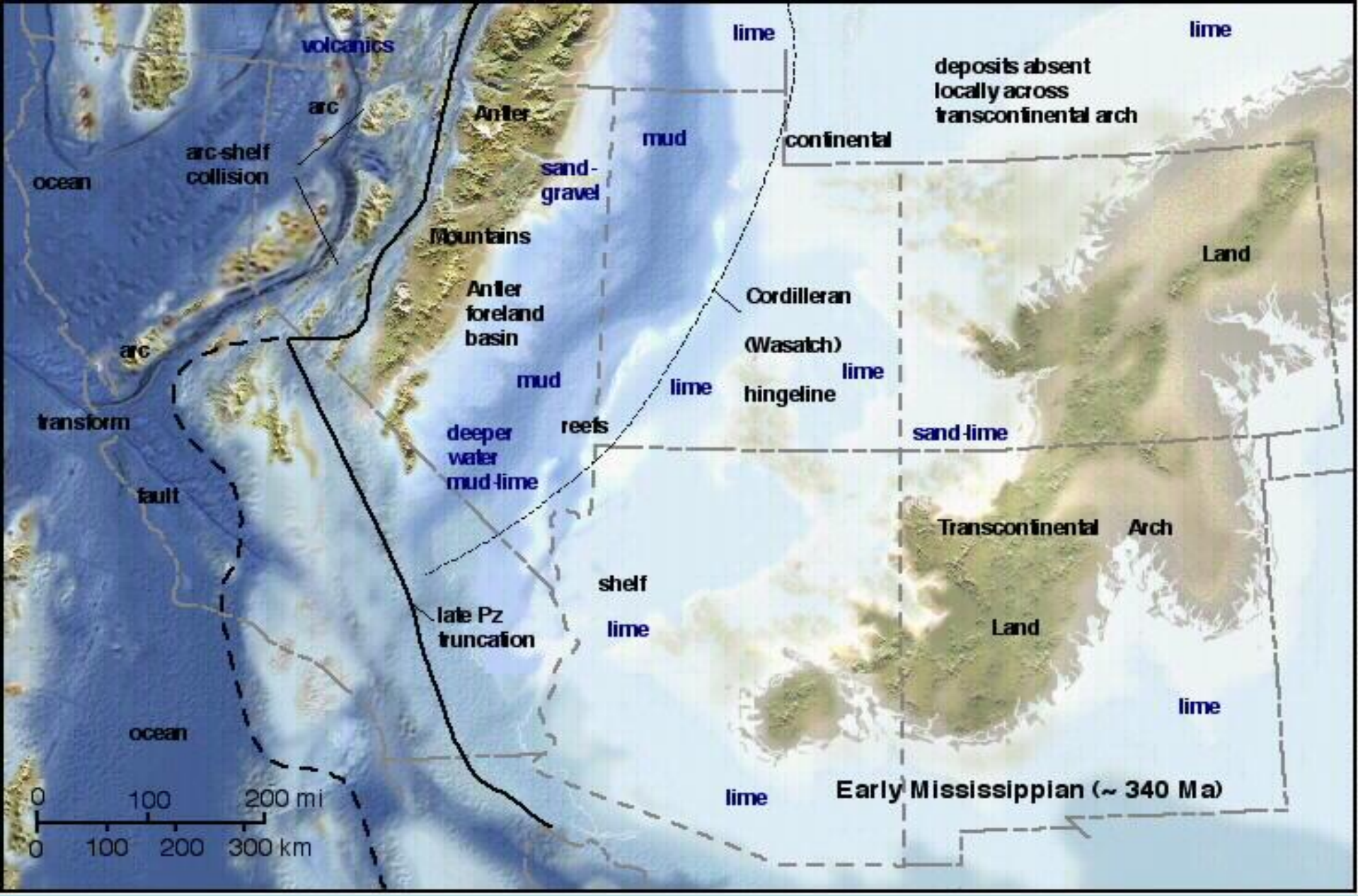
USGS

Hydrogeology of Eastern Nevada

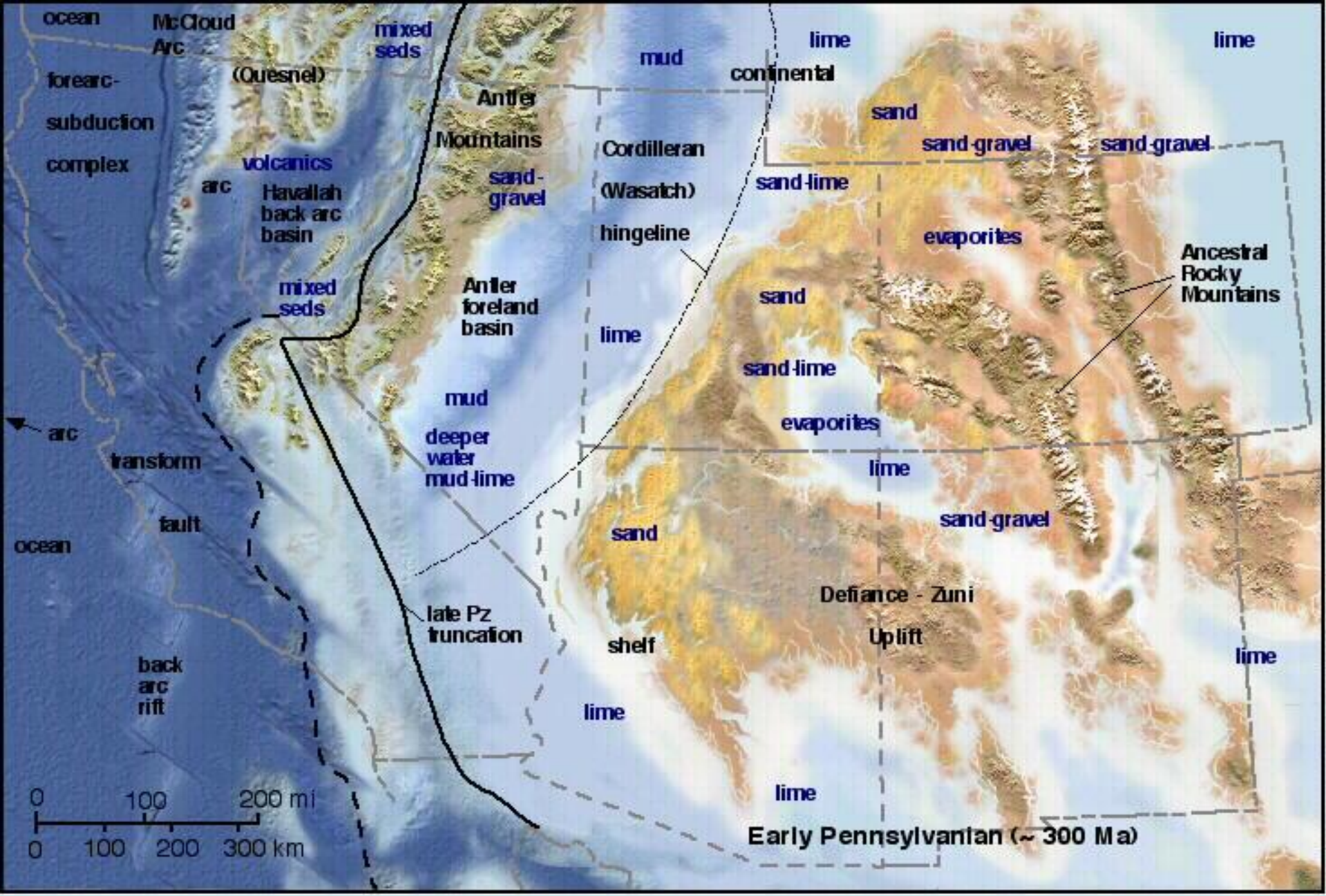
- Geology of the Basin and Range
- Carbonate Flow System in Eastern Nevada
- Water Budget Inputs and Outputs

USGS


Sierra Nevada
Wasatch Range
Basin fill
Low permeability consolidated rock
Permeable consolidated rock
Hydrogeologic Units
150 mi
200 km
USGS



From Dr. Ronald Blakey, Northern Arizona University, accessed at http://jan.ucc.nau.edu on June 14, 2005. Used with permission of author.



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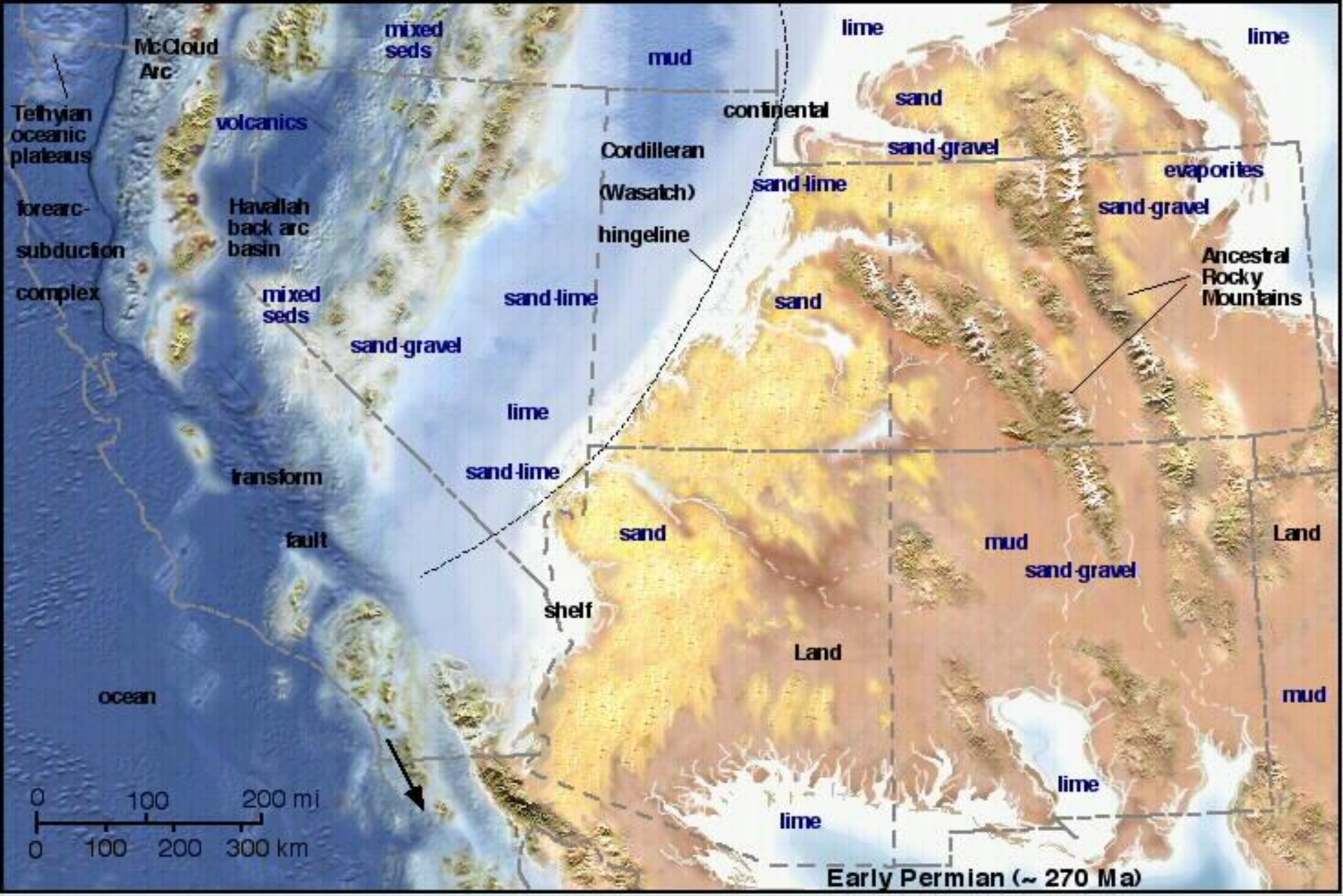

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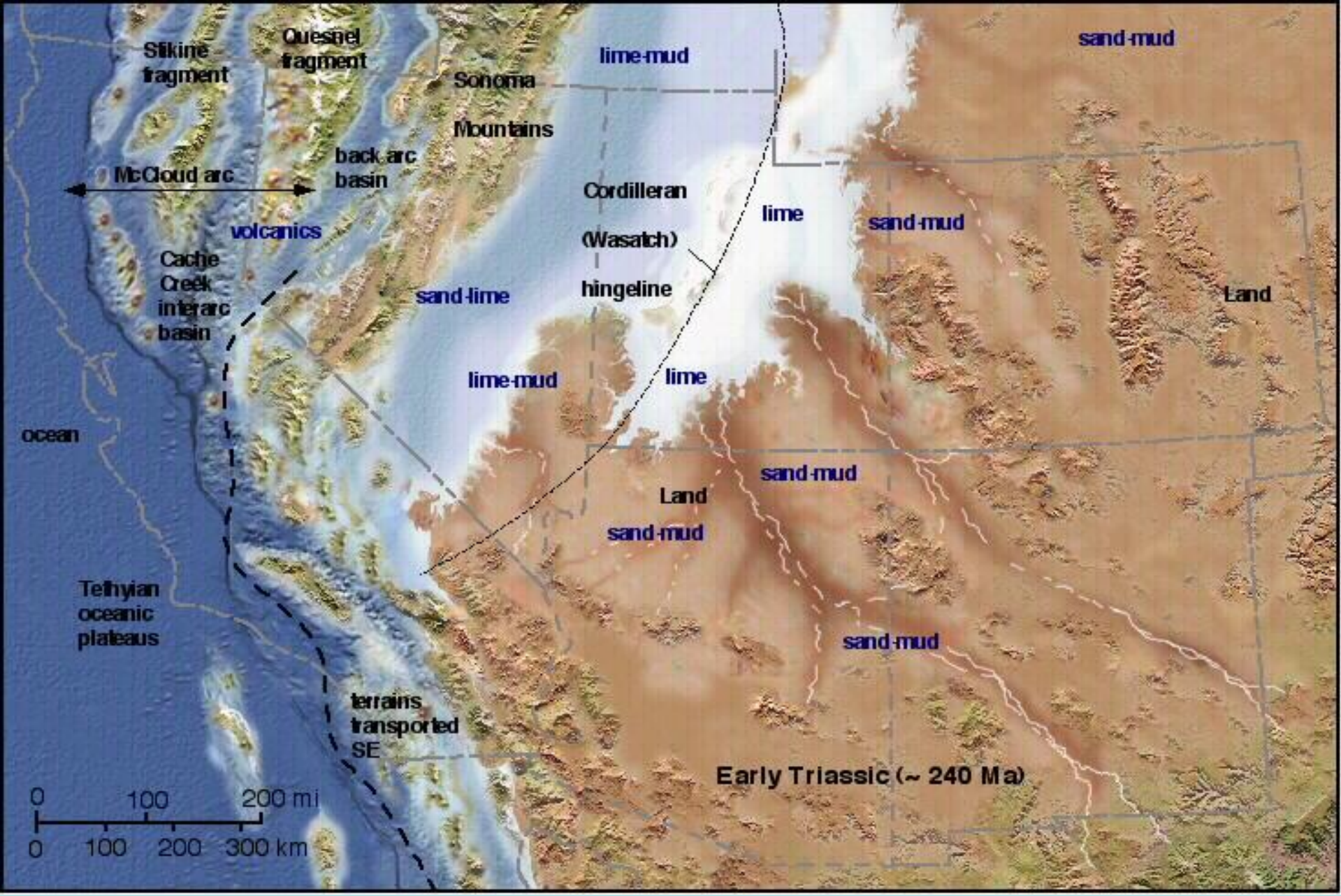

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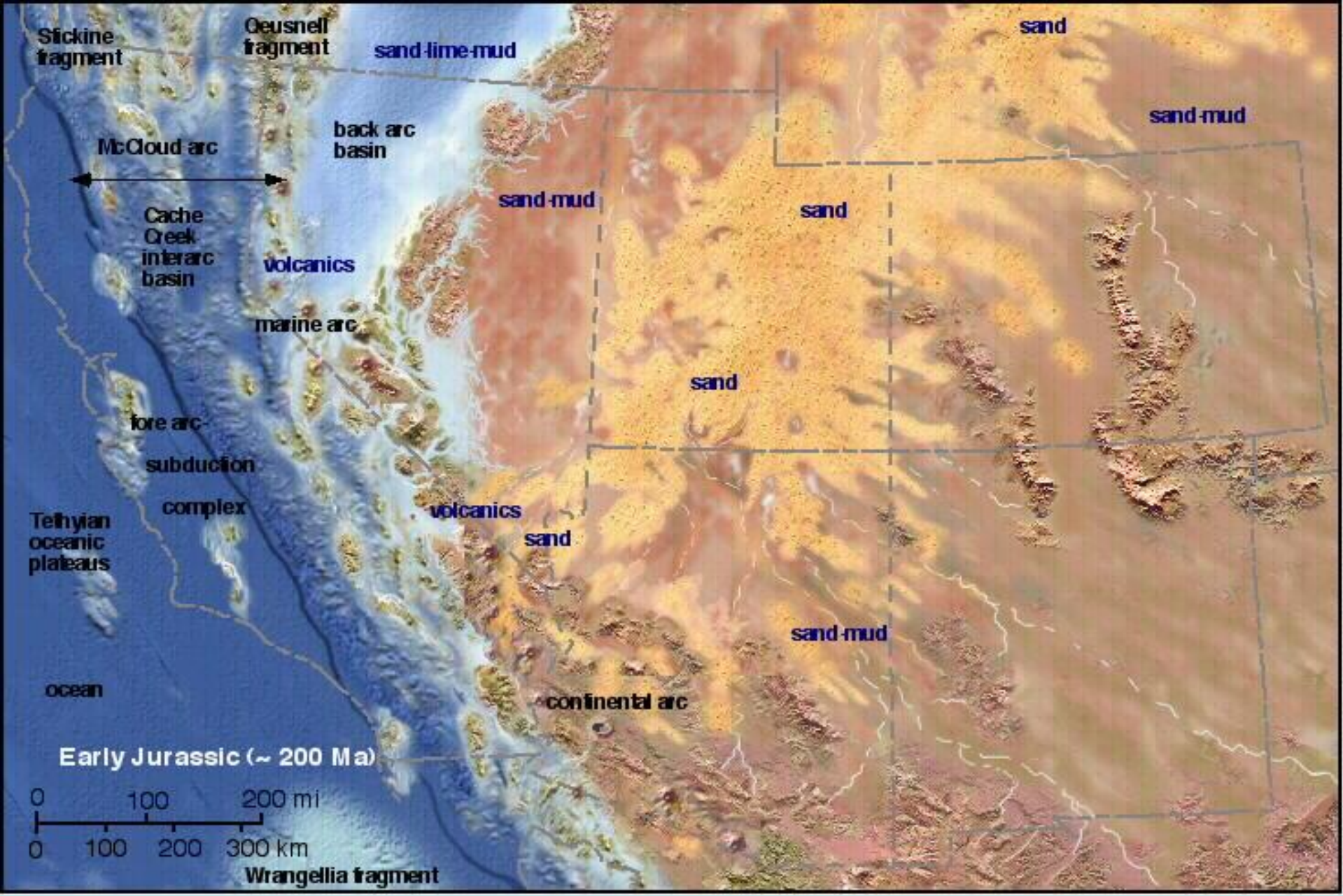

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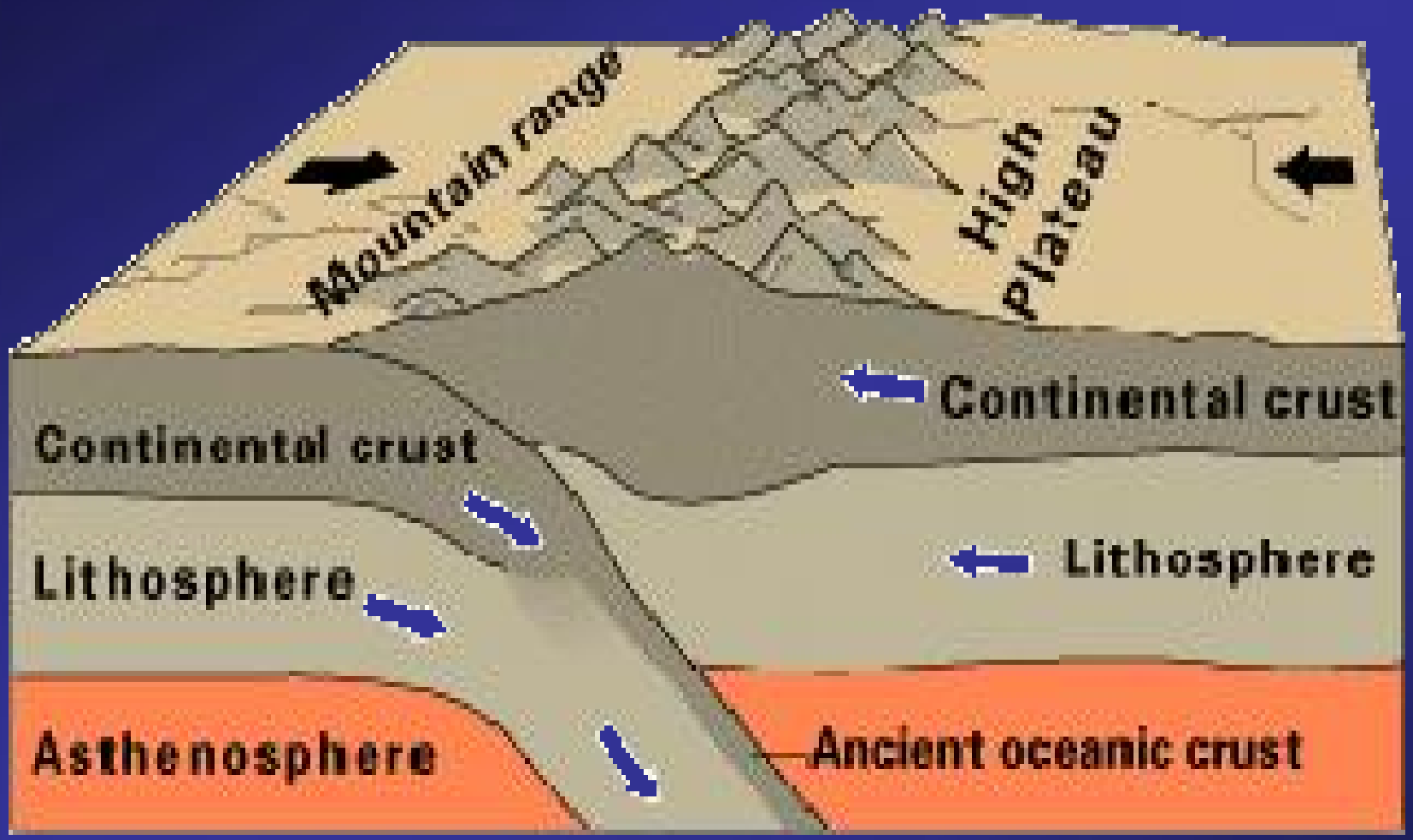
Mountain range
High plateau
Continental crust
Continental crust
Lithosphere
Lithosphere
Asthenosphere
Ancient oceanic crust

USGS

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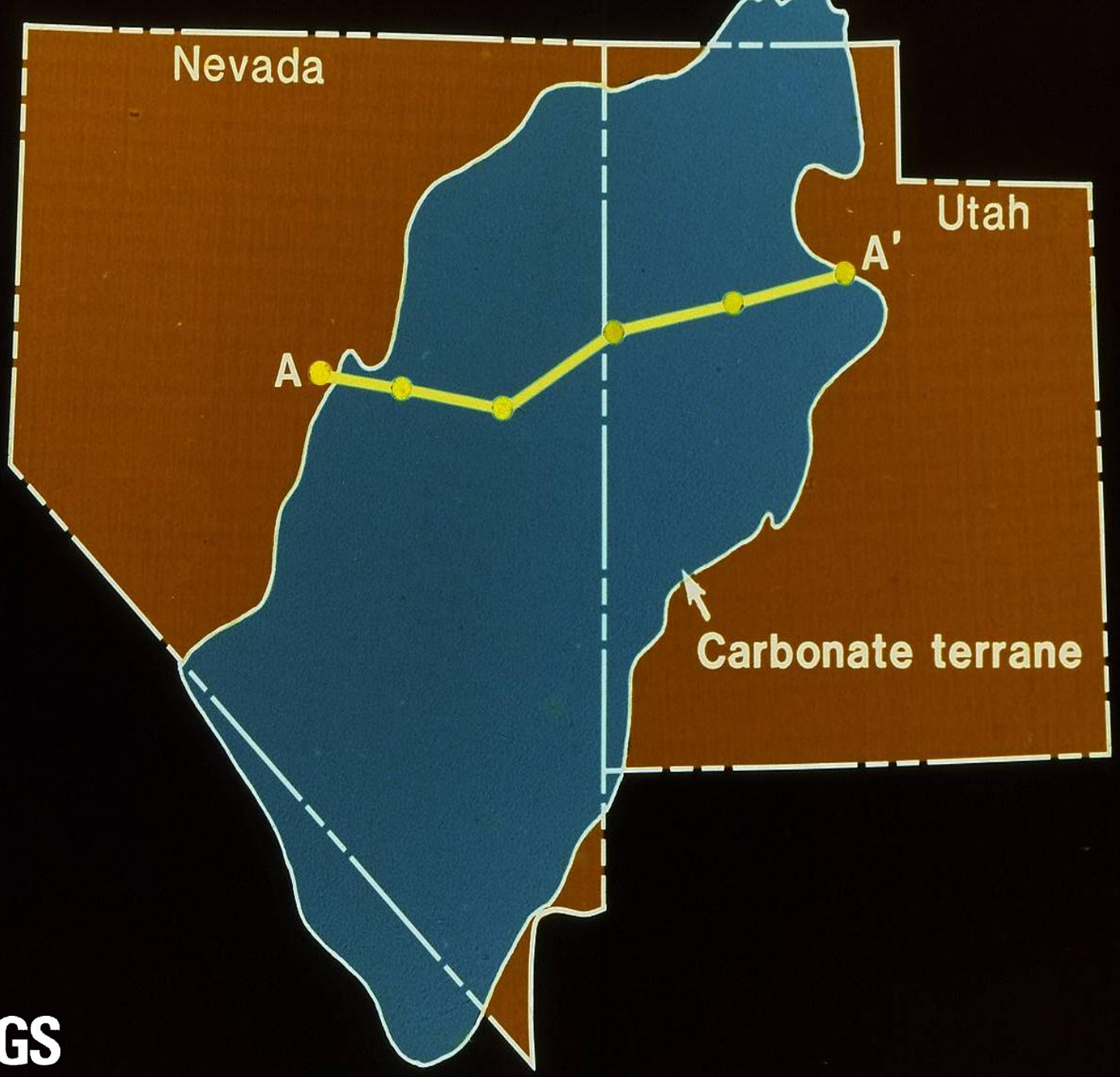
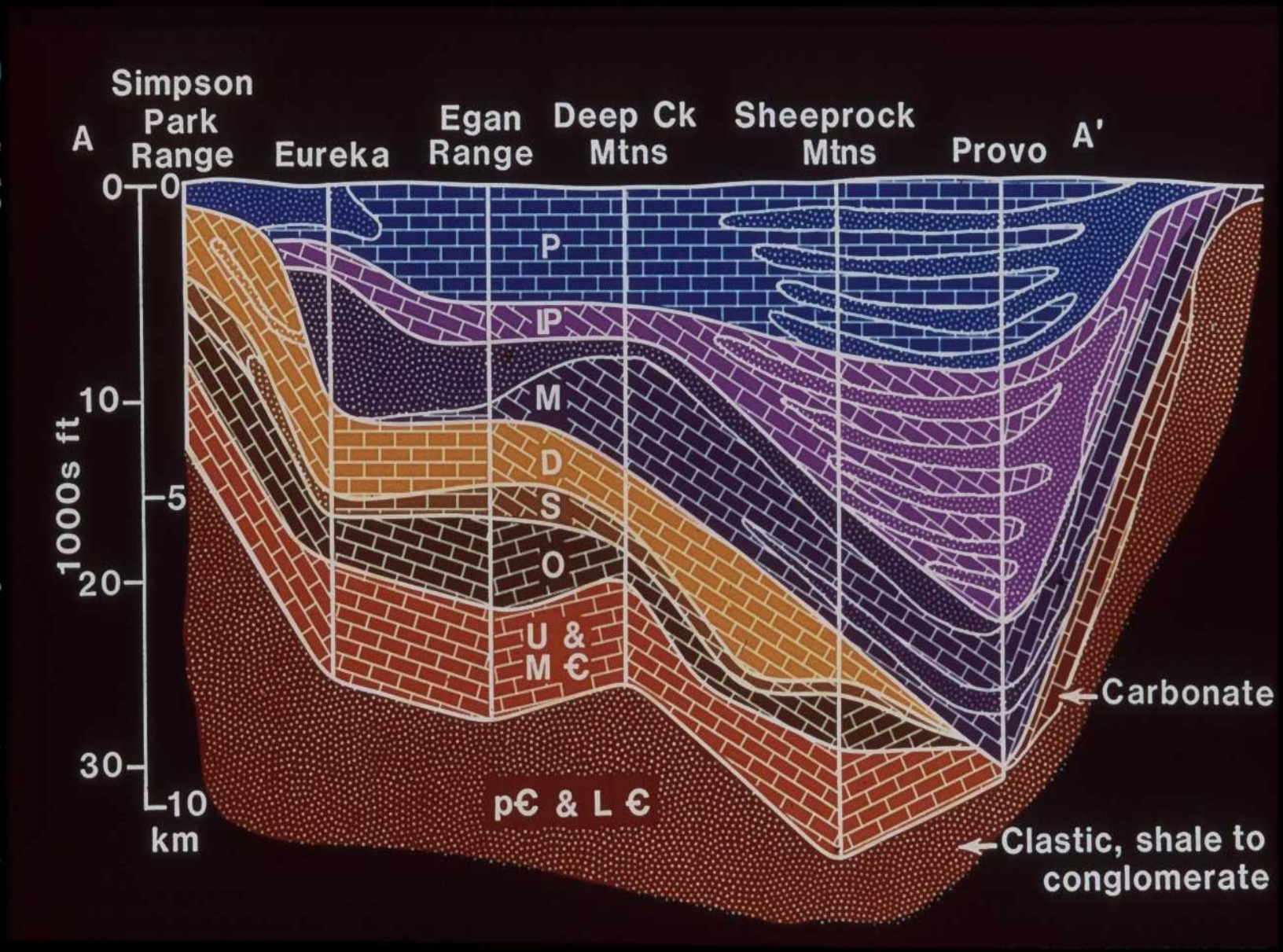
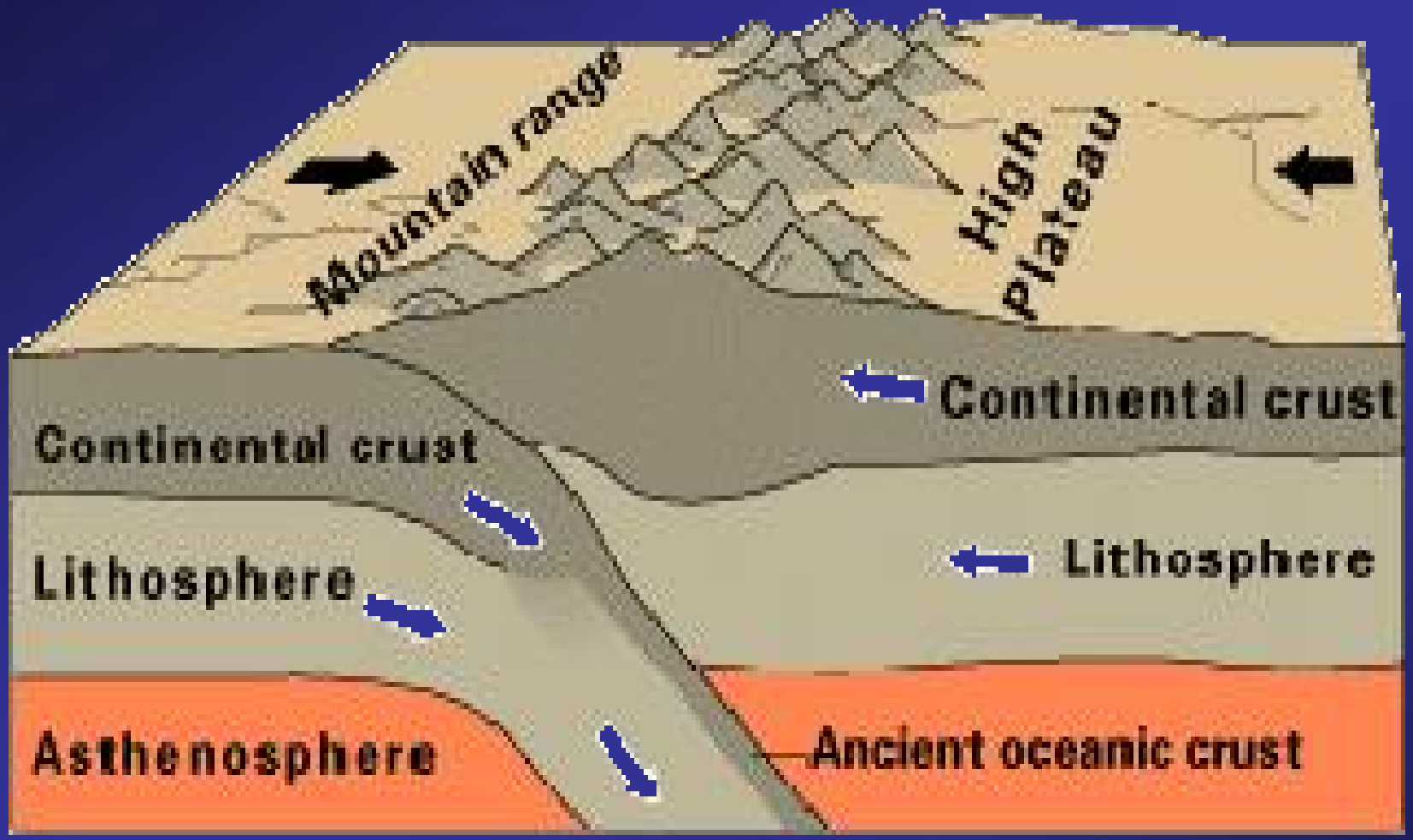


USGS

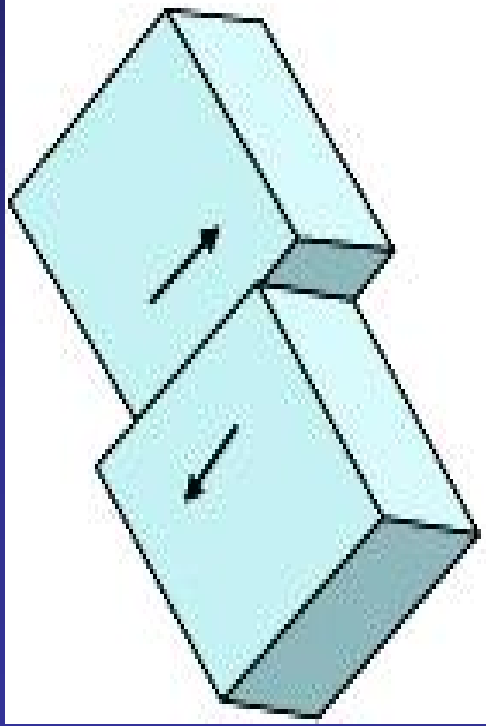

A
Simpson Park Range
Eureka
Egan Range
Deep Ck Mtns
Sheeprock Mtns
Provo
A'
0
0
10
5
20
30
10
1000s ft
km
P
IP
M
D
S
O
U & M €
p€ & L €
Carbonate
Clastic, shale to conglomerate

USGS

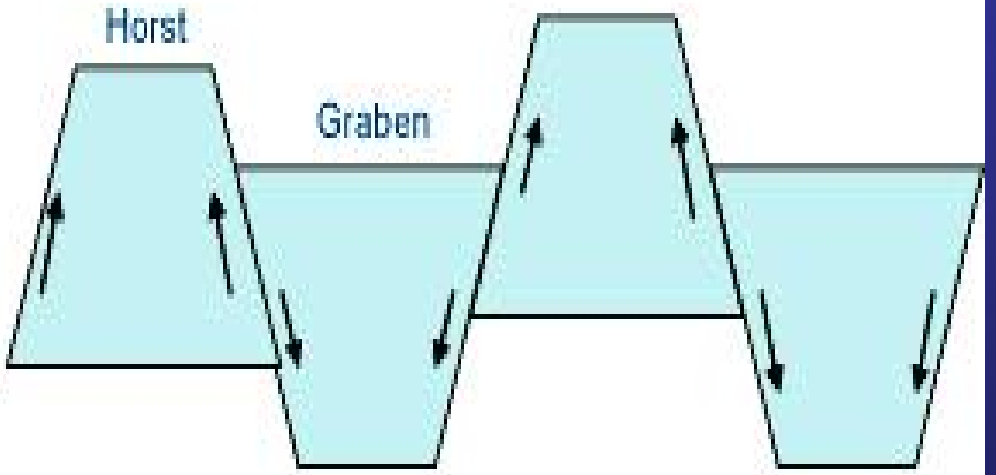

Mountain range
High plateau
Continental crust
Continental crust
Lithosphere
Lithosphere
Asthenosphere
Ancient oceanic crust

USGS

COMPRESSION



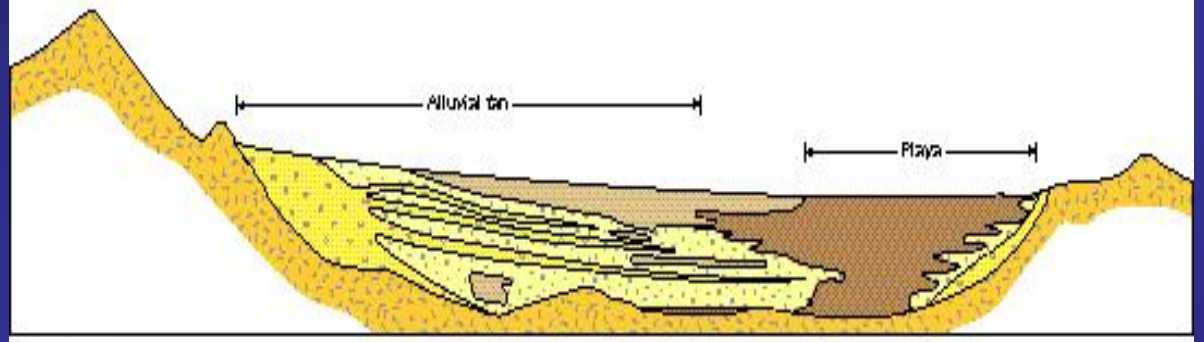
EXTENSION



USGS


USGS

Figure 24. A diagrammatic hydrogeologic section of a basin shows the interlayering of fine and coarse sediments from the edge to the center. Although the coarsest materials are at the edge of the basin, extreme depth to ground water may prevent efficient water-supply development.



NOT TO SCALE

Modified from Thompson, 1929

EXPLANATION

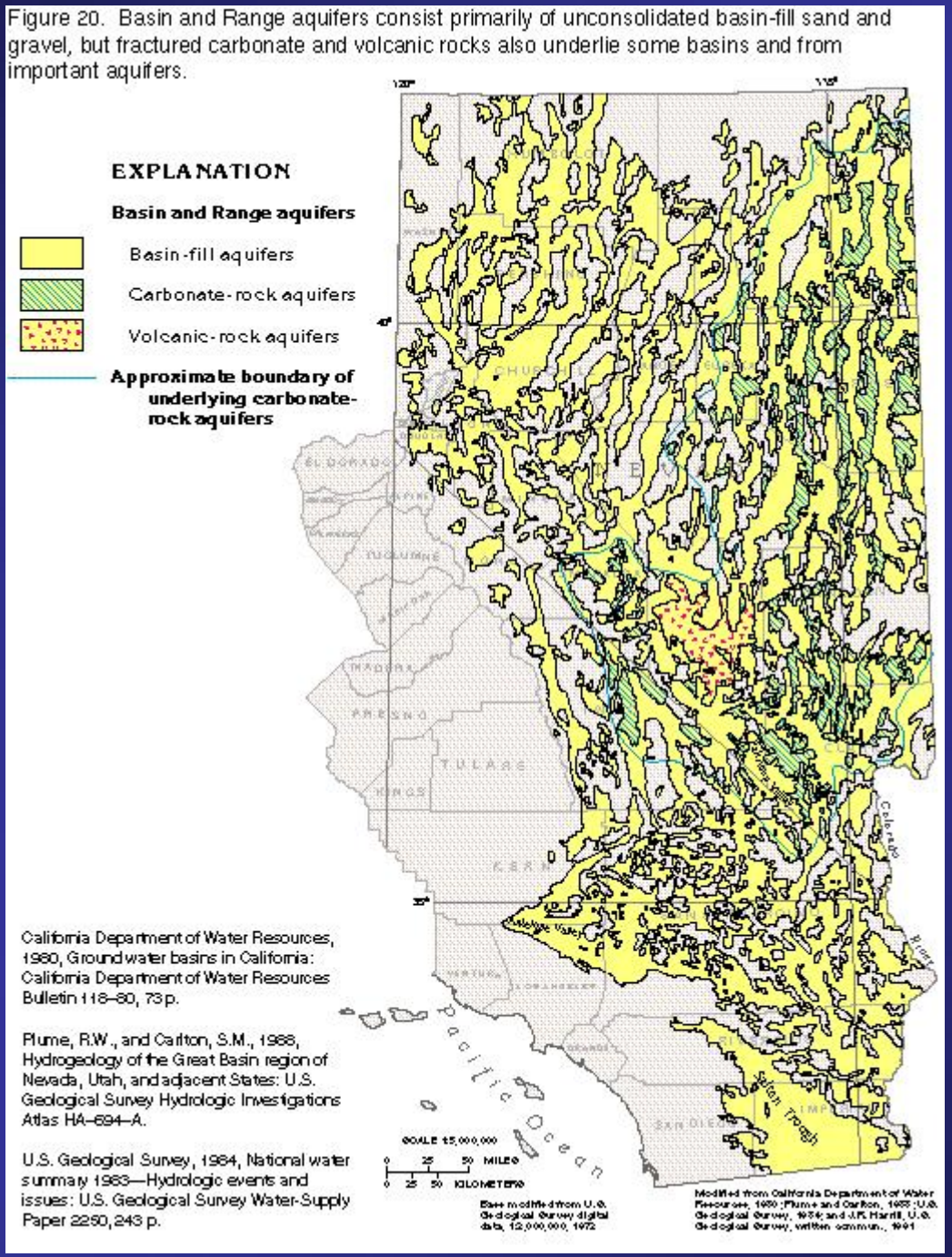
- Gravel
- Sand
- Clay
- Clay, silt, and evaporites deposited in a lake or on a playa
- Low-permeability bedrock

Thompson, D.G., 1929, The Mohave Desert region, California, a geographic, geologic, and hydrologic reconnaissance: U.S. Geological Survey Water-Supply Paper 578, 759 p.

From Planert, M., and Williams, J.S., 1995, Ground water atlas of the United States, Segment 1, California and Nevada: U.S. Geological Survey Hydrologic Investigations Atlas 730-B, 28 p.

USGS

Figure 20. Basin and Range aquifers consist primarily of unconsolidated basin-fill sand and gravel, but fractured carbonate and volcanic rocks also underlie some basins and from important aquifers.



California Department of Water Resources, 1980, Groundwater basins in California: California Department of Water Resources Bulletin 118–80, 73 p.

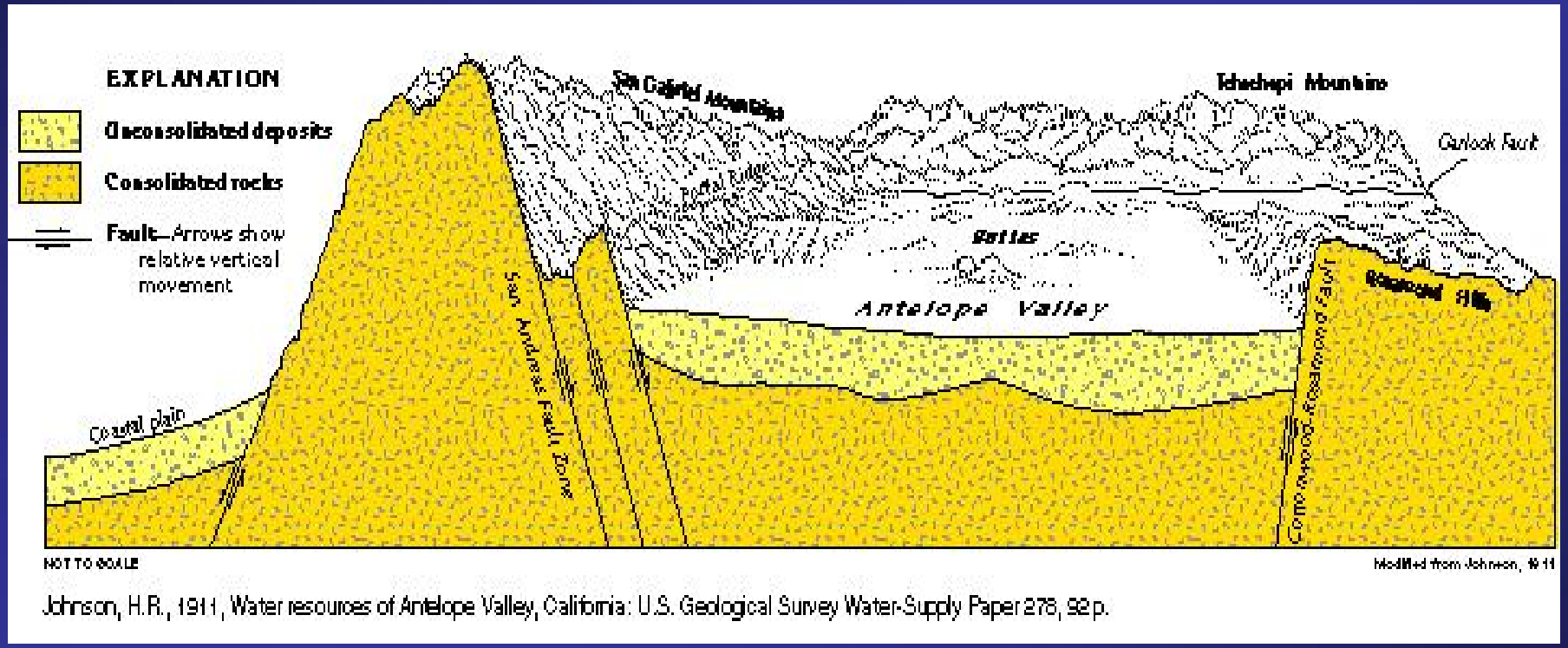
Plume, R.W., and Carlton, S.M., 1988, Hydrogeology of the Great Basin region of Nevada, Utah, and adjacent States: U.S. Geological Survey Hydrologic Investigations Atlas HA–694–A.

U.S. Geological Survey, 1984, National water summary 1983—Hydrologic events and issues: U.S. Geological Survey Water-Supply Paper 2250, 243 p.

From Planert, M., and Williams, J.S., 1995, Ground water atlas of the United States, Segment 1, California and Nevada: U.S. Geological Survey Hydrologic Investigations Atlas 730-B, 28 p.

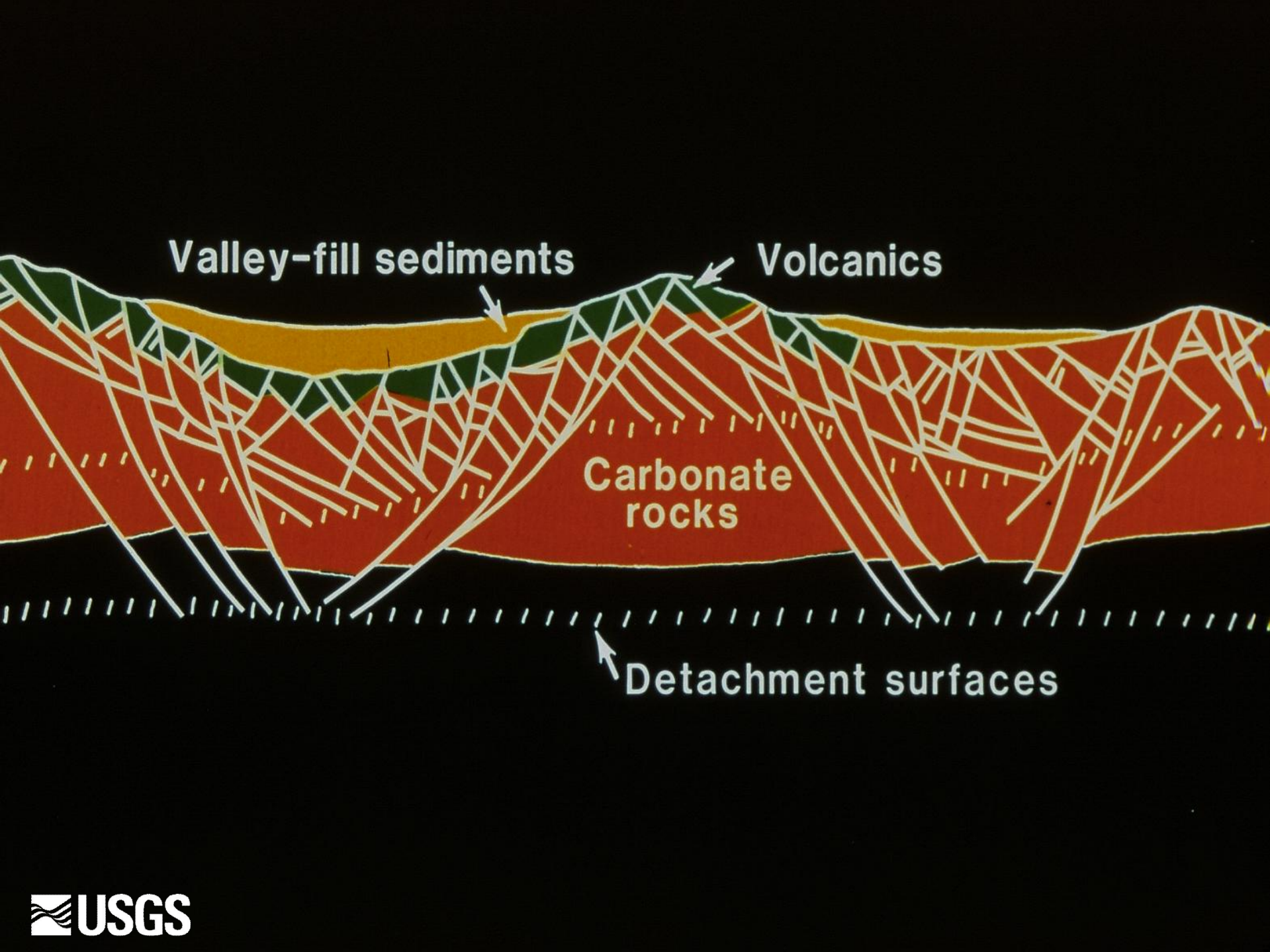
USGS

Figure 1. – Diagram showing probable block and fault systems of the Antelope Valley region.

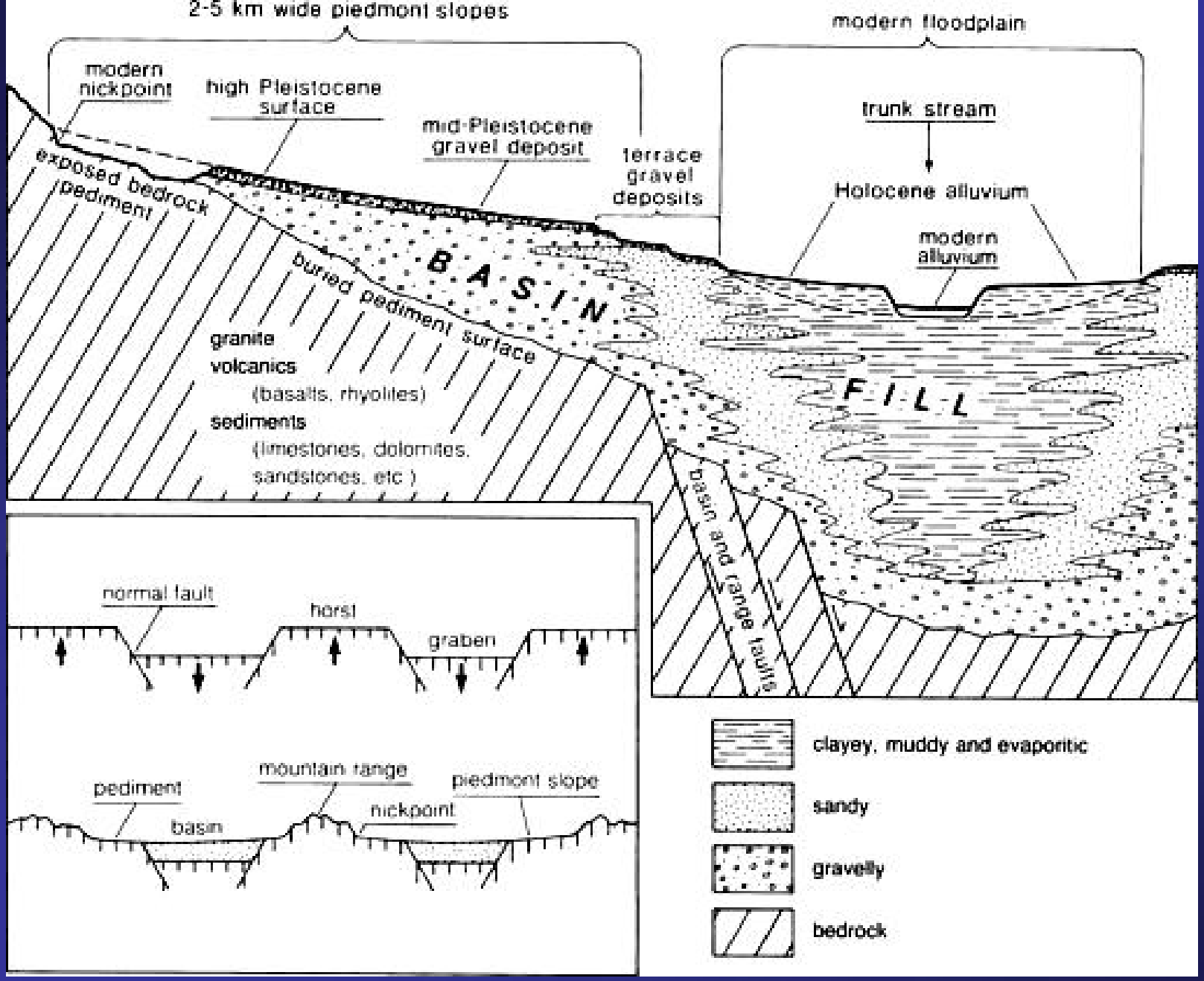


Johnson, H.R., 1911, Water resources of Antelope Valley, California: U.S. Geological Survey Water-Supply Paper 278, 92 p.

USGS

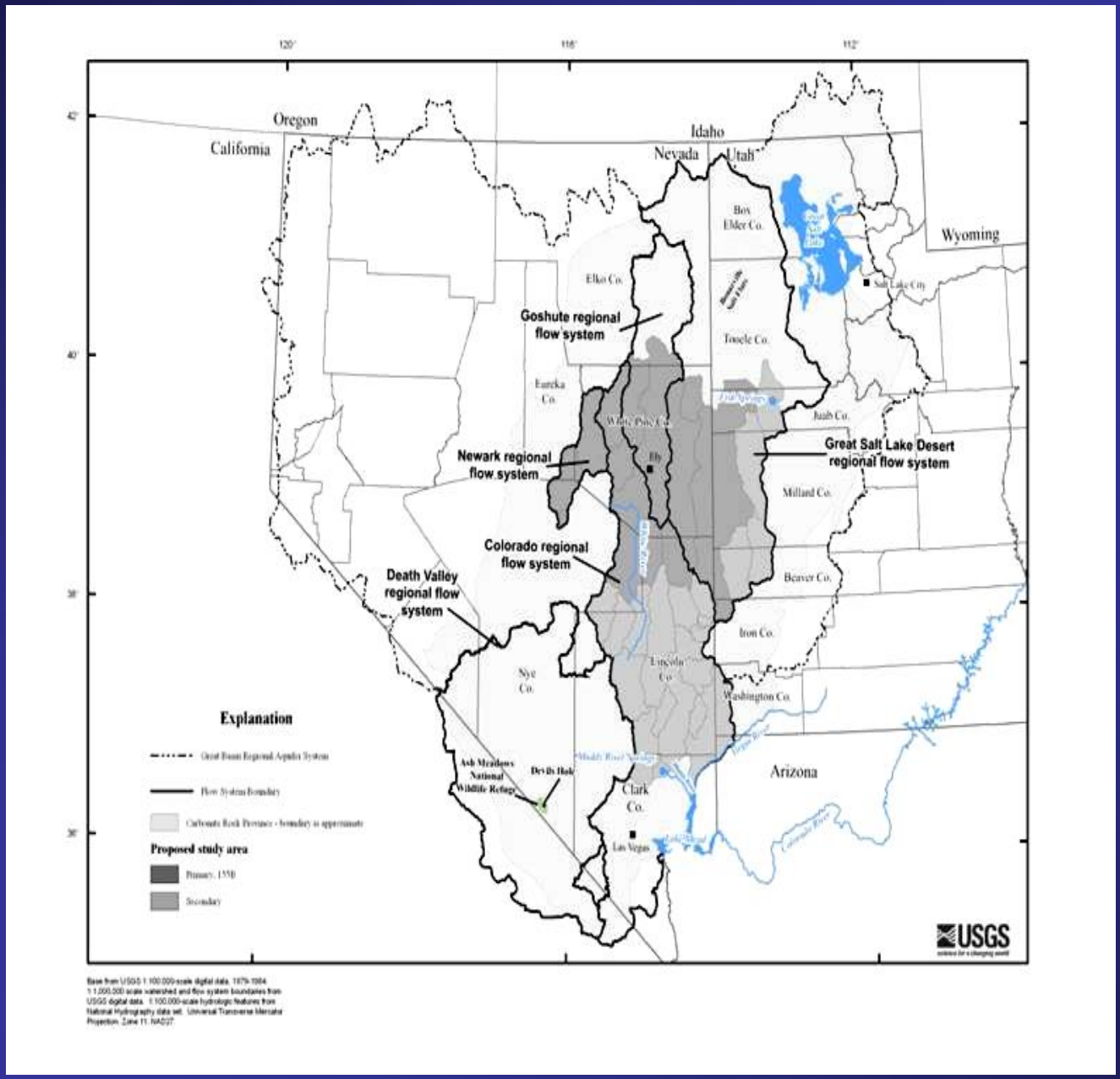

Valley-fill sediments
Volcanics
Carbonate rocks
Detachment surfaces

USGS


2-5 km wide piedmont slopes
modern floodplain
modern nickpoint
high Pleistocene surface
mid-Pleistocene gravel deposit
terrace gravel deposits
trunk stream
Holocene alluvium
modern alluvium
exposed bedrock pediment
buried pediment surface
B A S I N
F I L L
granite
volcanics
(basalts, rhyolites)
sediments
(limestones, dolomites, sandstones, etc.)
basin and range faults
normal fault
horst
graben
pediment
mountain range
piedmont slope
nickpoint
basin
clayey, muddy and evaporitic
sandy
gravelly
bedrock

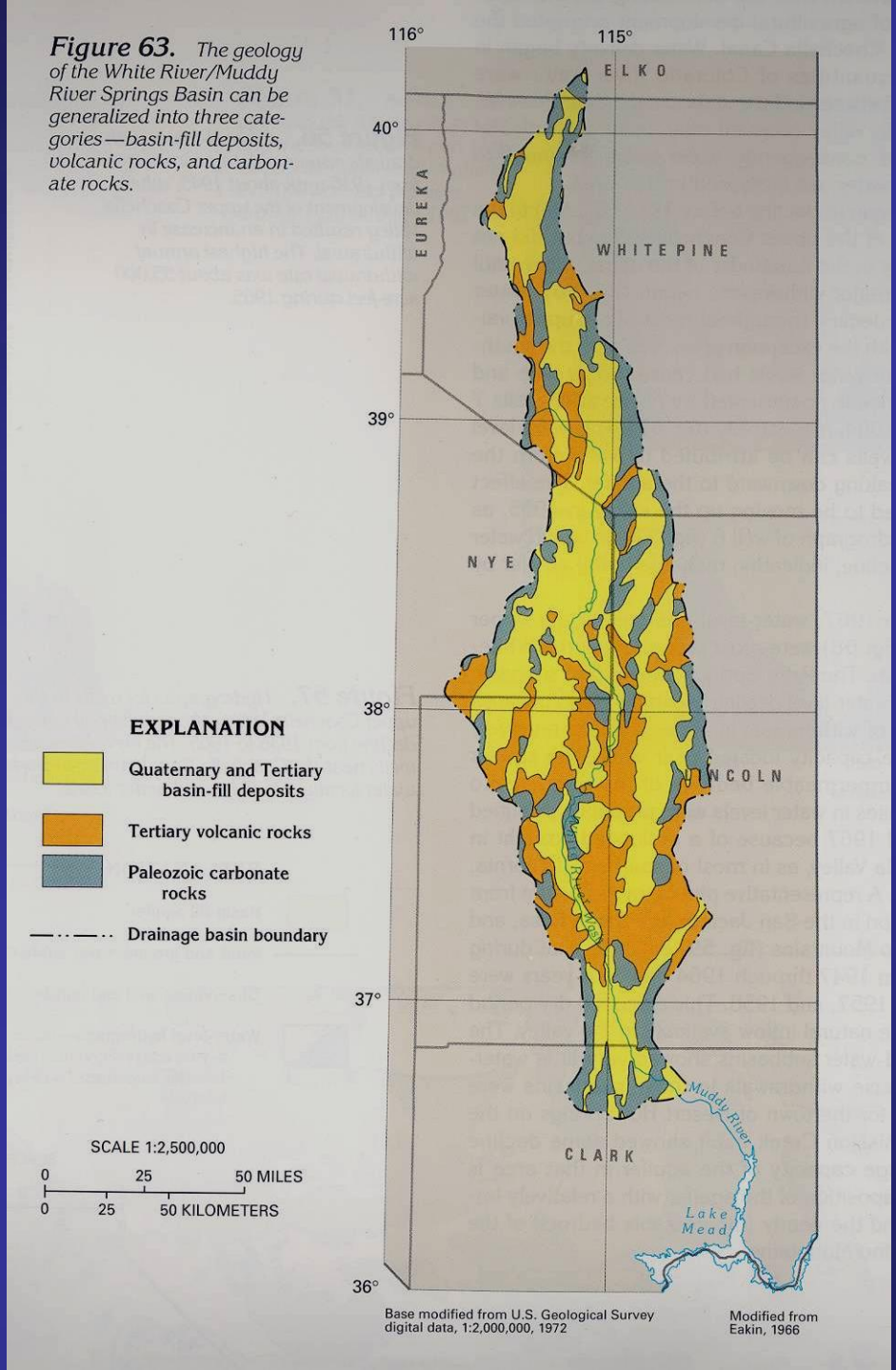
USGS


USGS



Base from USGS 1:100,000-scale digital data, 1979-1984
1:1,000,000 scale watershed and flow system boundaries from USGS digital data, 1:100,000-scale hydrologic features from National Hydrography data set, Universal Transverse Mercator Projection, Zone 11, NAD27

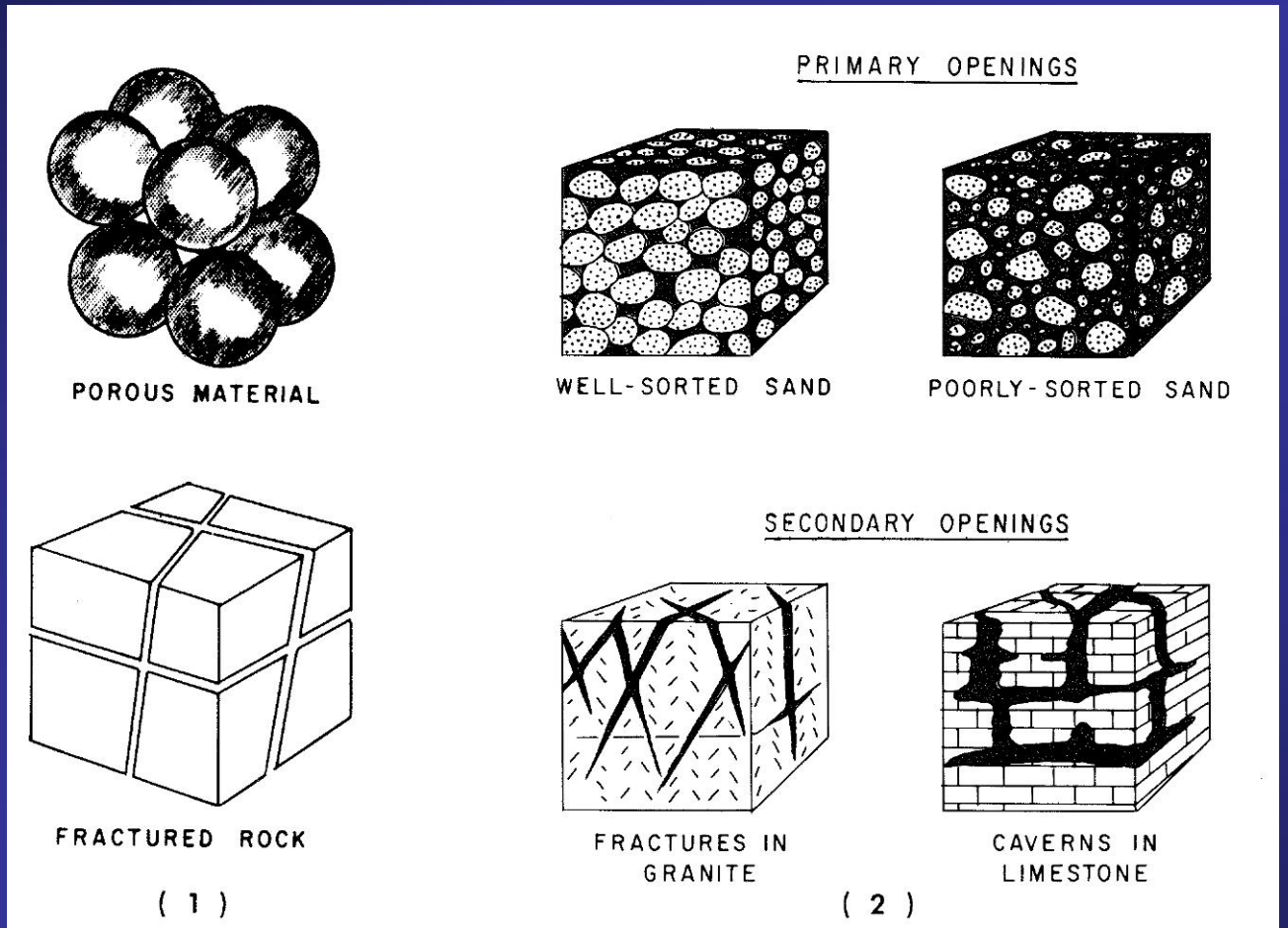
USGS



Modified from Eakin, T.E., 1966, A regional interbasin ground-water system in the White River area, southeastern Nevada: Water Resources Research, v. 2, no. 2, p. 251-271.

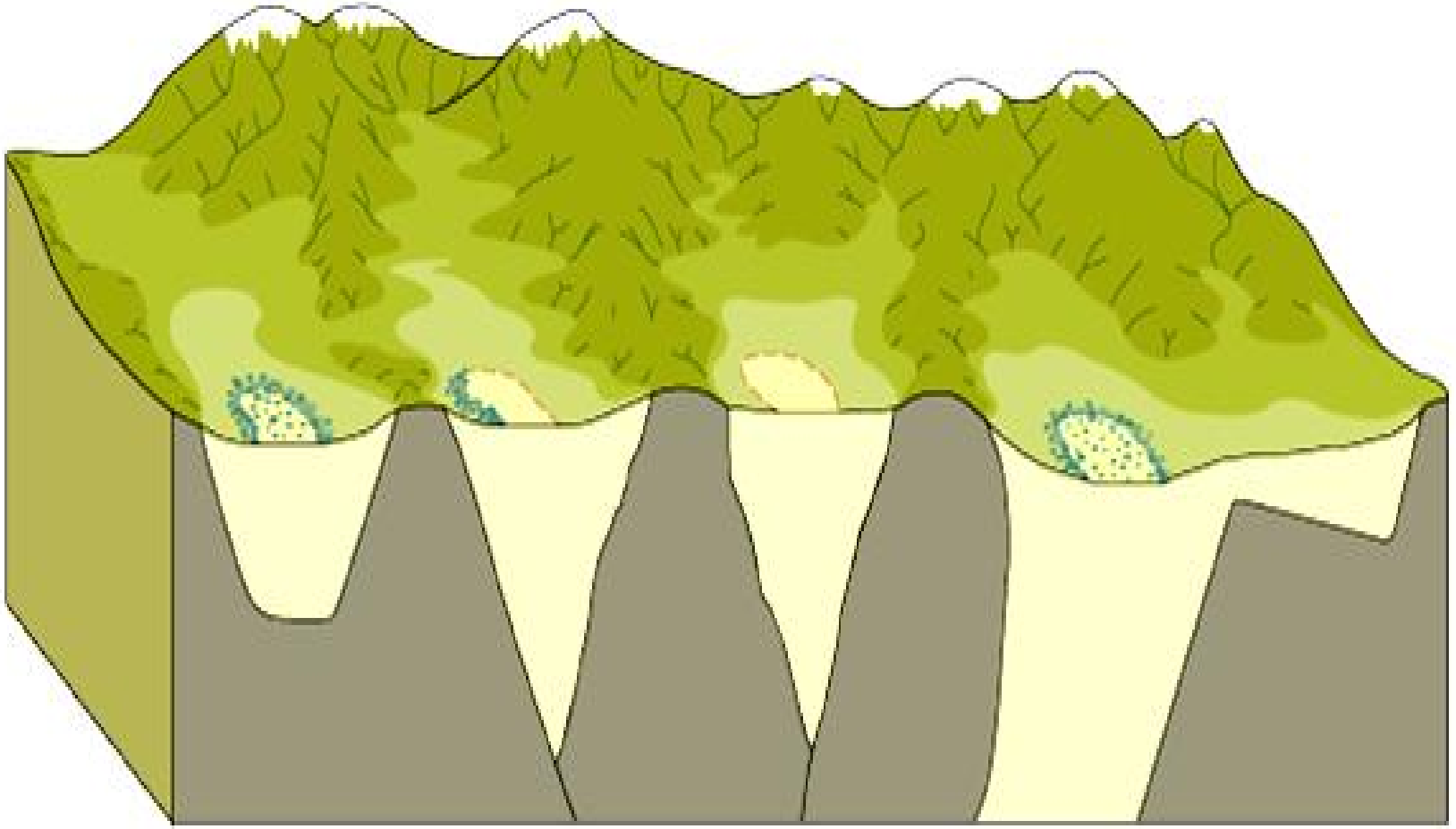
From Planert, M., and Williams, J.S., 1995, Ground water atlas of the United States, Segment 1, California and Nevada: U.S. Geological Survey Hydrologic Investigations Atlas 730-B, 28 p.

USGS



(from Heath, 1989, Basic ground-water hydrology: U.S. Geological Survey Water-Supply Paper 2220, 84 p.)


USGS



USGS

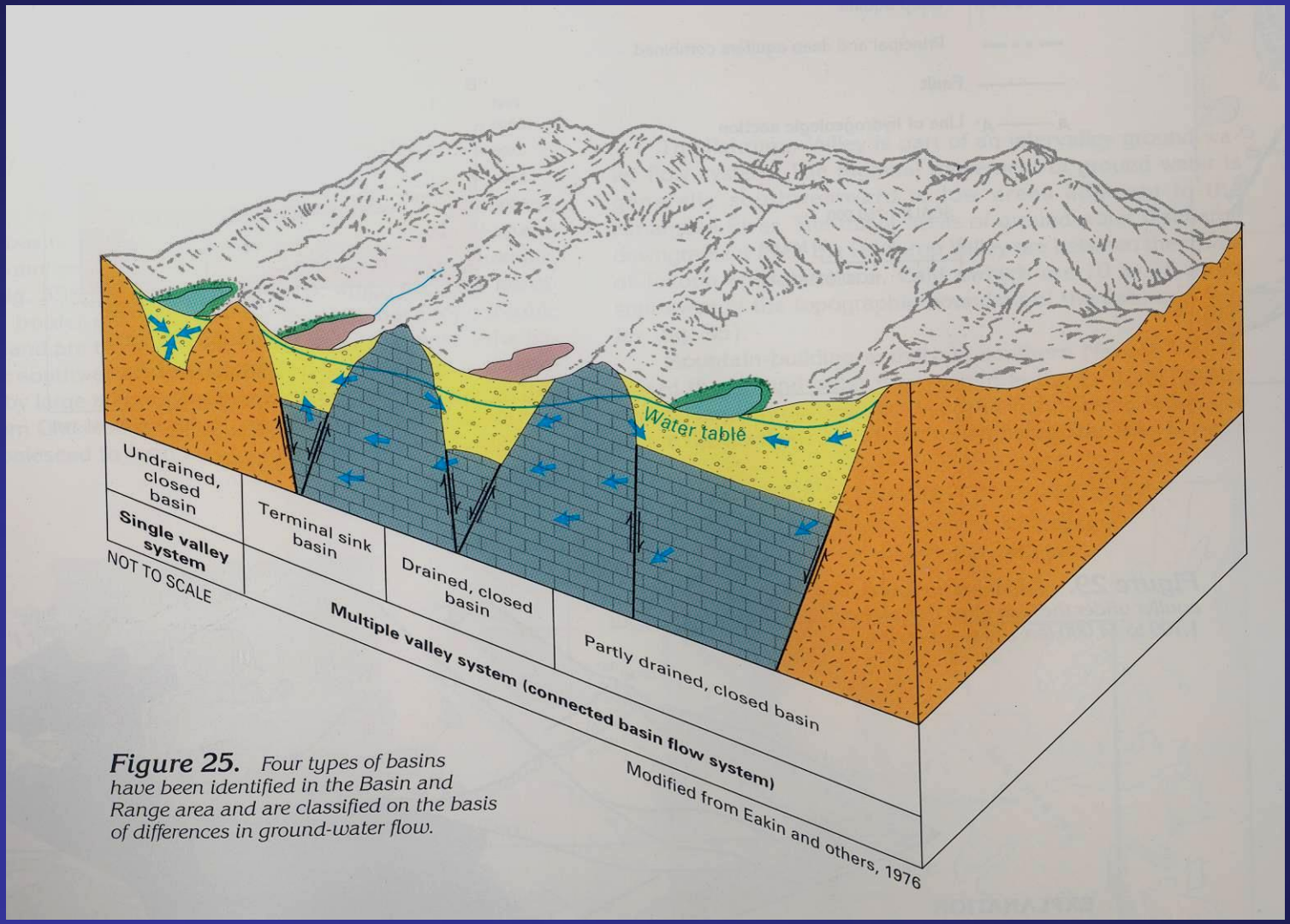
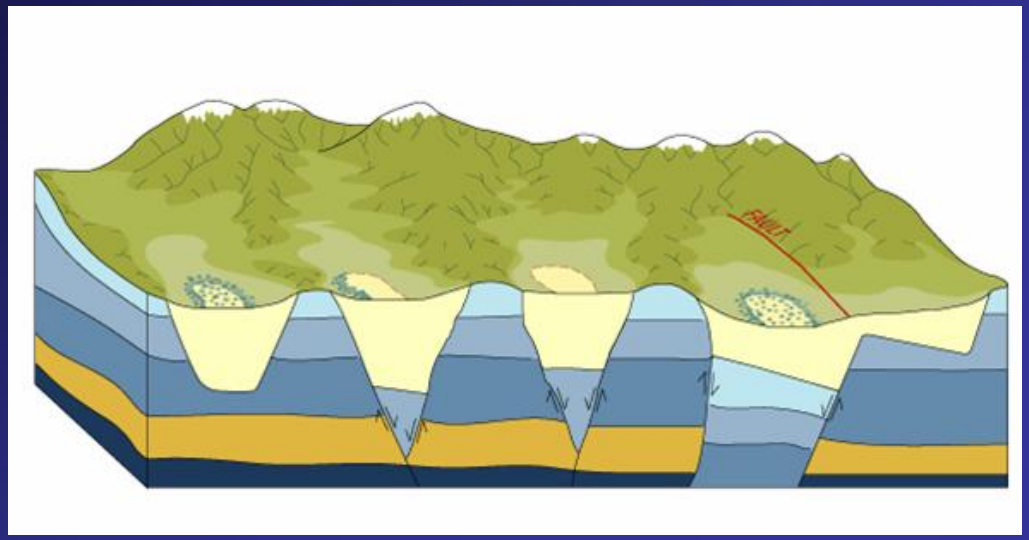


Figure 25. *Four types of basins have been identified in the Basin and Range area and are classified on the basis of differences in ground-water flow.*

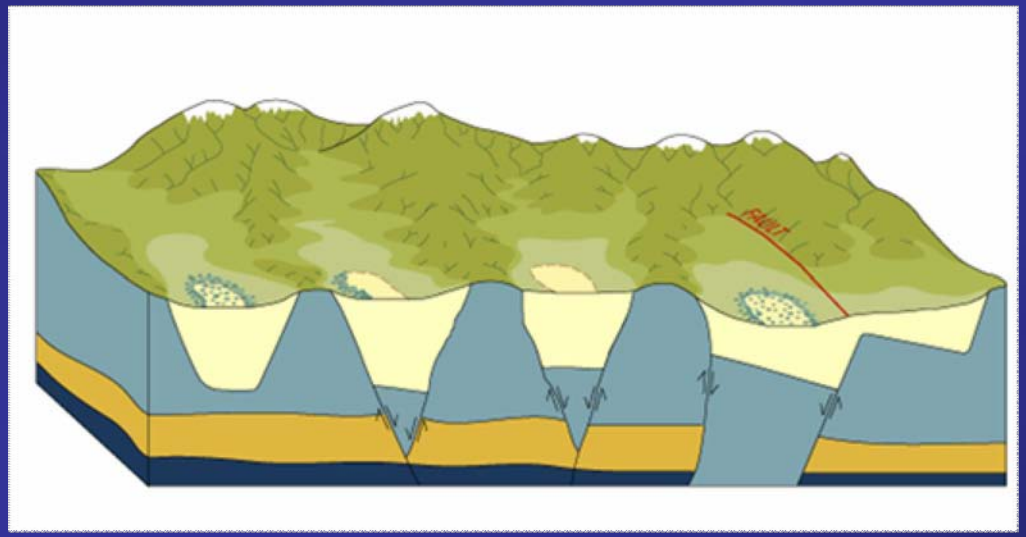
Modified from Eakin, T.E., Price, Don, and Harrill, J.R., 1976, Summary appraisals of the Nation's ground-water Resources – Great Basin region: U.S. Geological Survey Professional Paper 813-G, 37 p.

From Planert, M., and Williams, J.S., 1995, Ground water atlas of the United States, Segment 1, California and Nevada: U.S. Geological Survey Hydrologic Investigations Atlas 730-B, 28 p.

USGS

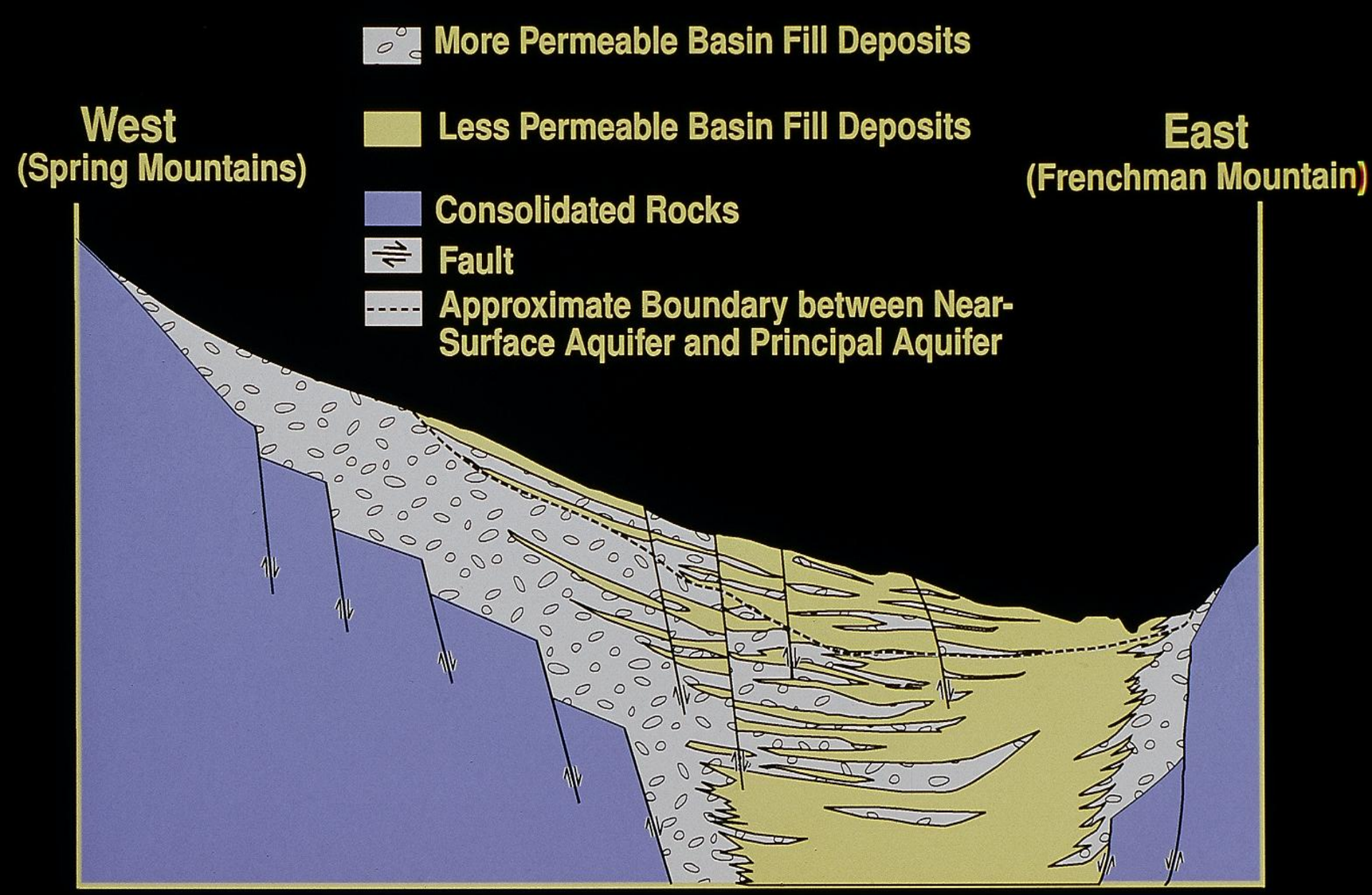


Geologic units



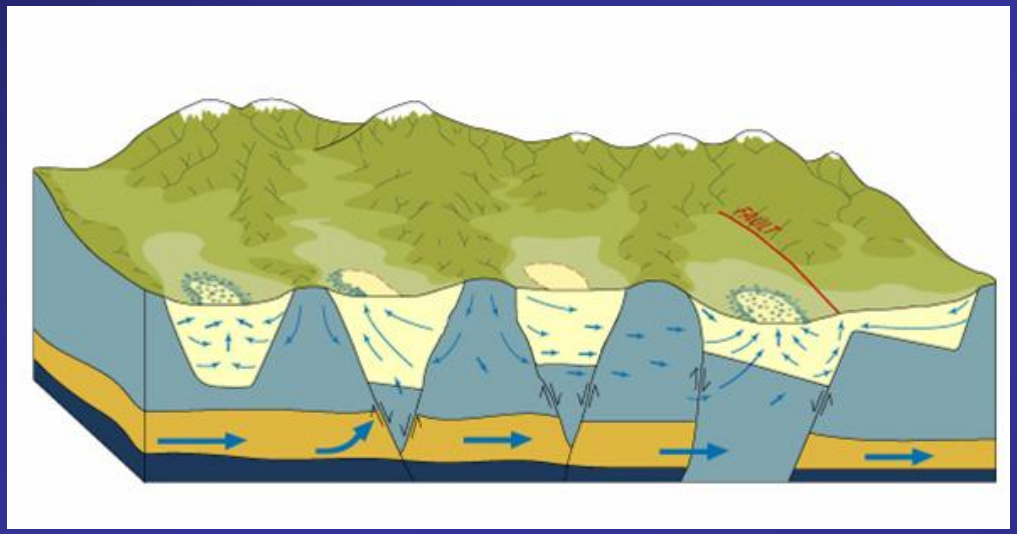
Aquifers

USGS



USGS

USGS WRD NV



Ground-water flow within and between basins (local verses regional flow)

USGS

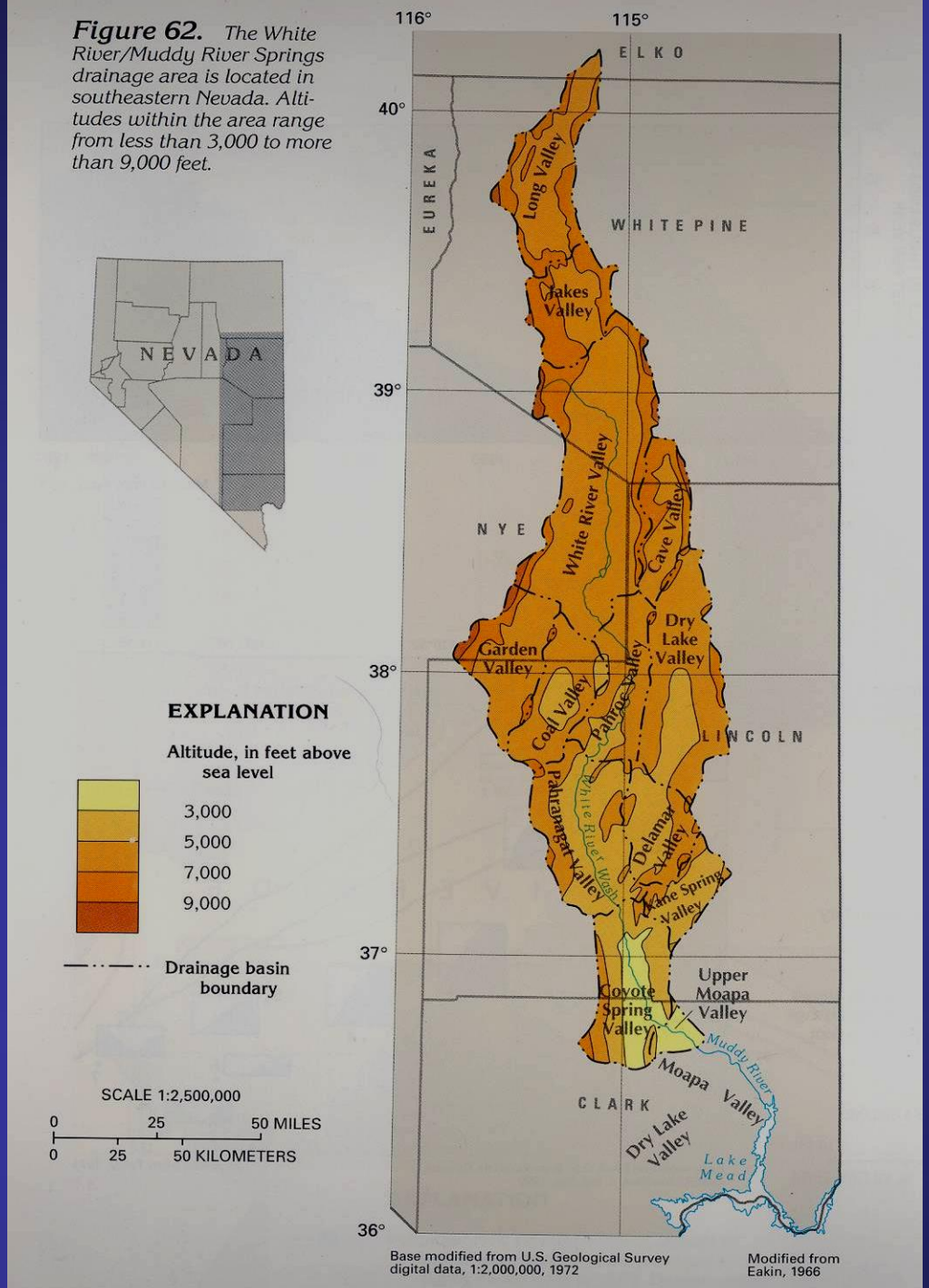
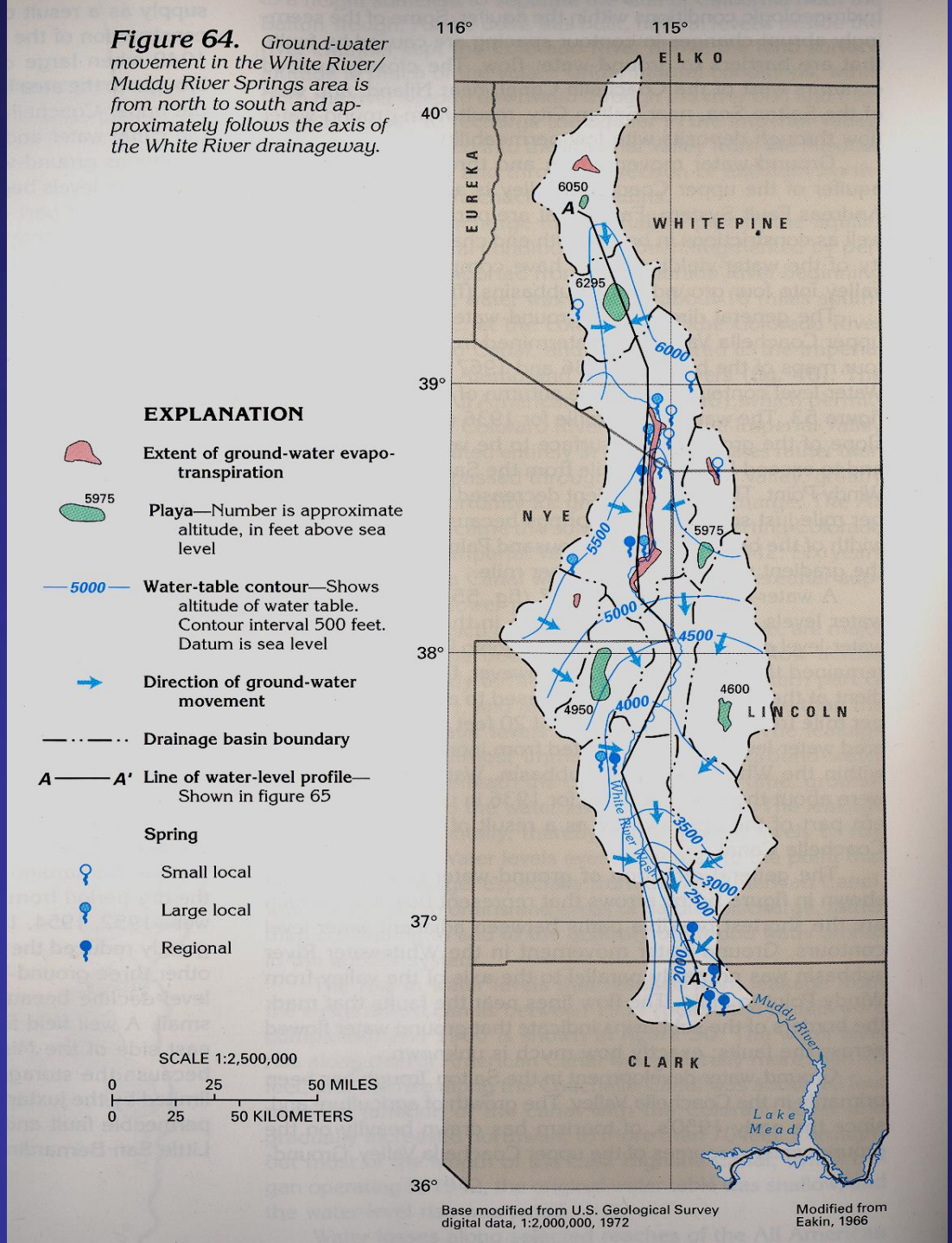


Figure 62. *The White River/Muddy River Springs drainage area is located in southeastern Nevada. Altitudes within the area range from less than 3,000 to more than 9,000 feet.*

Modified from Eakin, T.E., 1966, A regional interbasin ground-water system in the White River area, southeastern Nevada: Water Resources Research, v. 2, no. 2, p. 251-271.

From Planert, M., and Williams, J.S., 1995, Ground water atlas of the United States, Segment 1, California and Nevada: U.S. Geological Survey Hydrologic Investigations Atlas 730-B, 28 p.

USGS

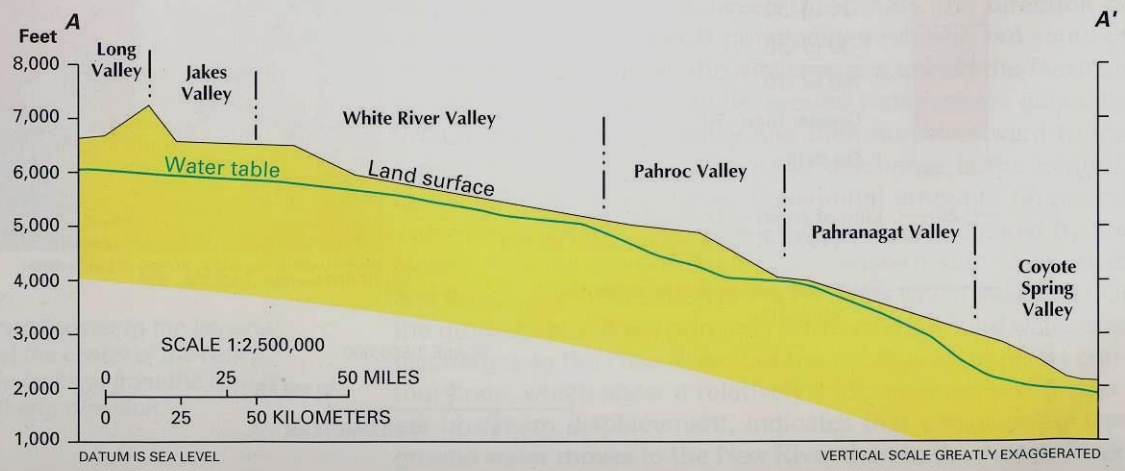


Modified from Eakin, T.E., 1966, A regional interbasin ground-water system in the White River area, southeastern Nevada: Water Resources Research, v. 2, no. 2, p. 251-271.

From Planert, M., and Williams, J.S., 1995, Ground water atlas of the United States, Segment 1, California and Nevada: U.S. Geological Survey Hydrologic Investigations Atlas 730-B, 28 p.

USGS

Figure 65. *A generalized north-south profile along the channel of the White River shows ground-water levels (blue line) and land surface altitude (black line) and reveals two areas of steep water-level gradient where faults might influence ground-water movement. The line of the profile is shown in figure 64.*



From Planert, M., and Williams, J.S., 1995, Ground water atlas of the United States, Segment 1, California and Nevada: U.S. Geological Survey Hydrologic Investigations Atlas 730-B, 28 p.

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Water Budgets – Inputs and Outputs to a Basin

Input = Output +/- Change

Recharge = Discharge +/- Change in Storage

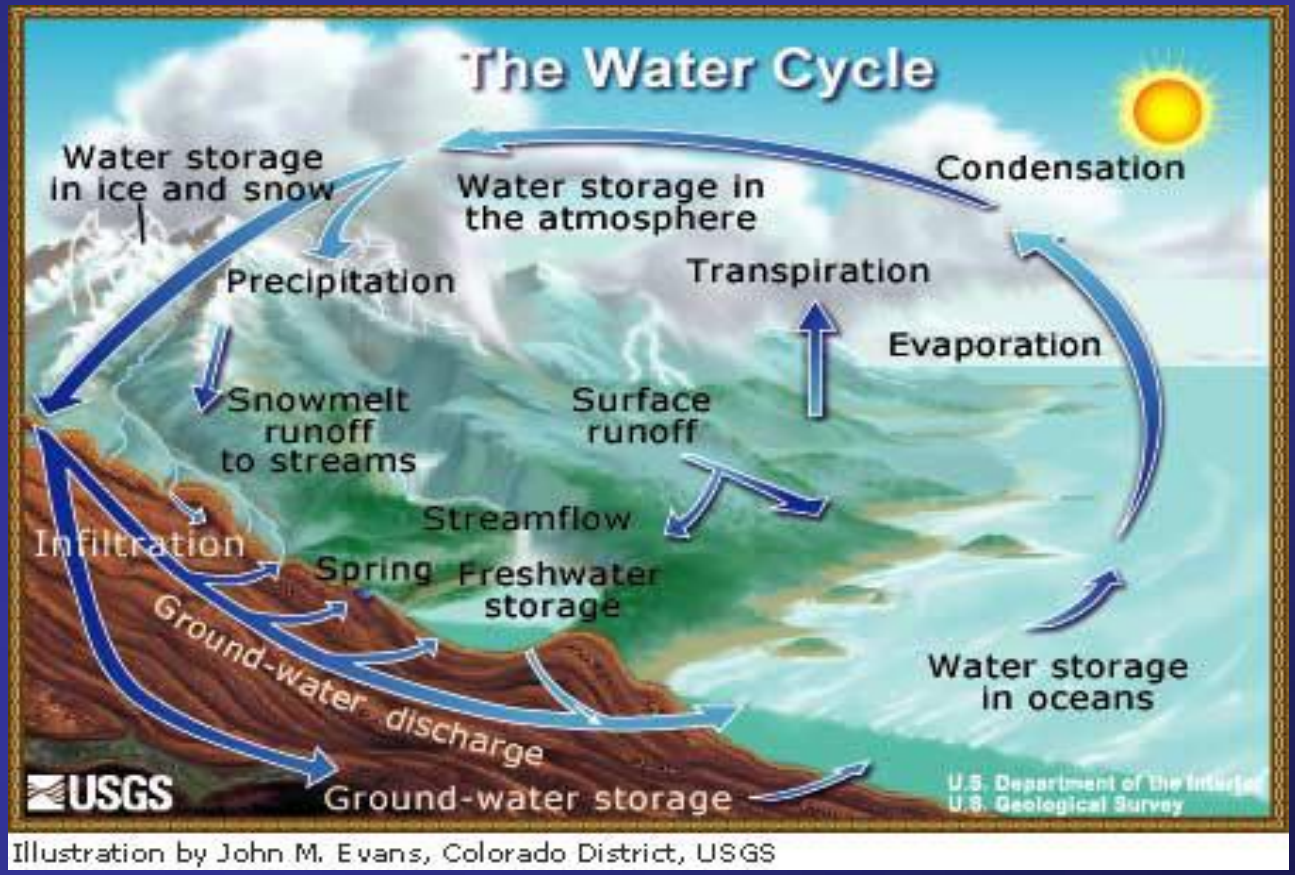
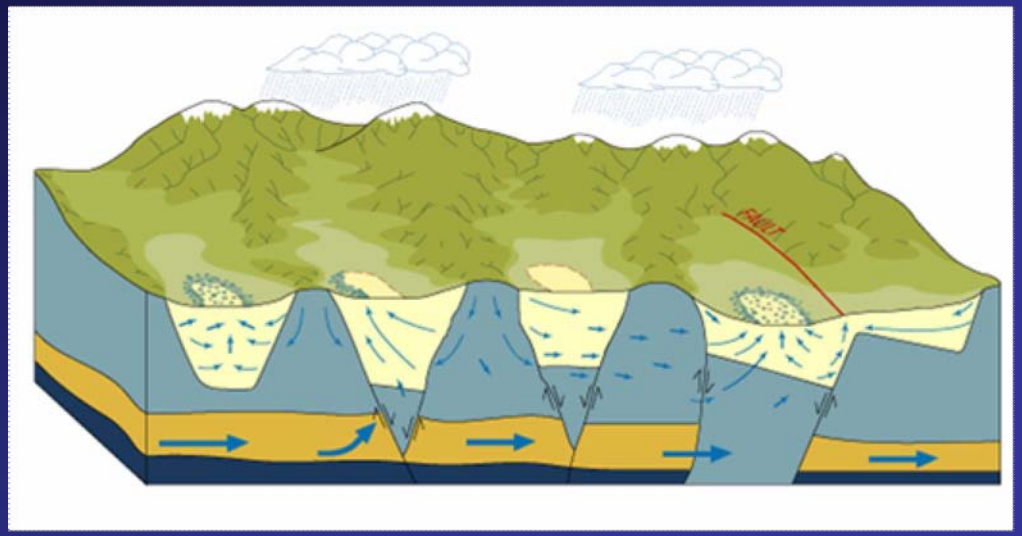
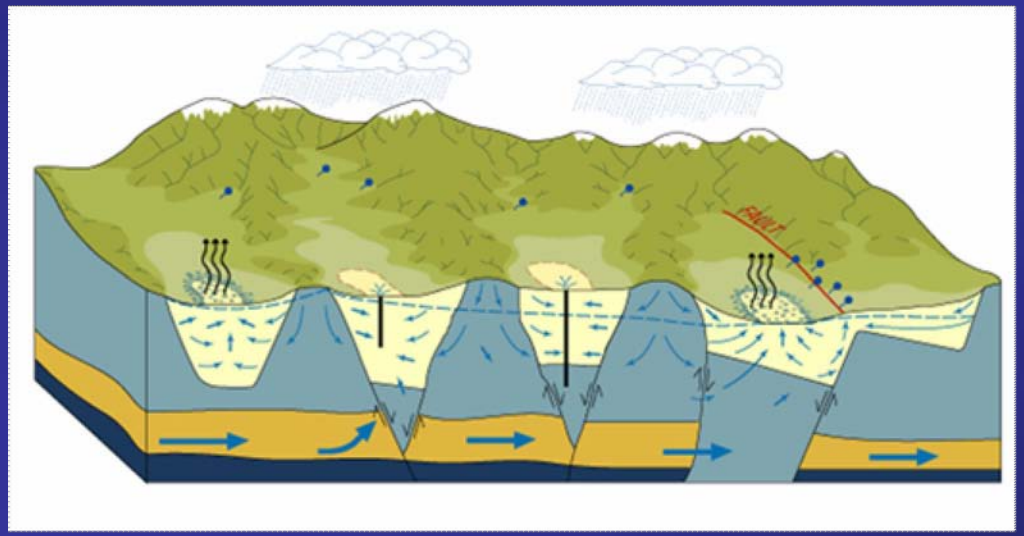


Illustration by John M. Evans, Colorado District, USGS

USGS

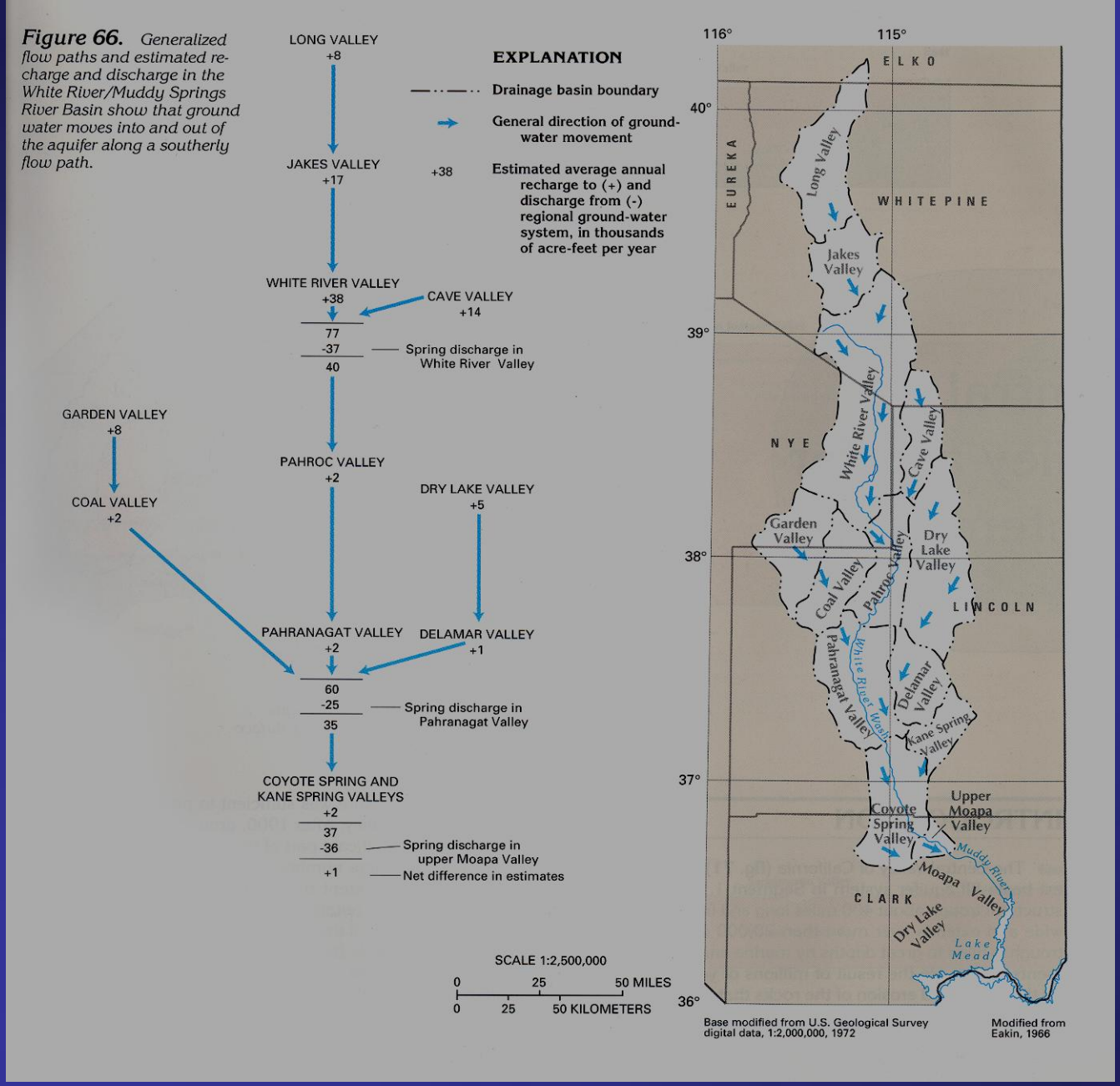


Recharge is from
- Rainfall
- Snowmelt
- Basin inflow



Discharge is from
- Springs
- Evapotranspiration
- Pumpage
- Basin outflow

USGS



Modified from Eakin, T.E., 1966, A regional interbasin ground-water system in the White River area, southeastern Nevada: Water Resources Research, v. 2, no. 2, p. 251-271.

From Planert, M., and Williams, J.S., 1995, Ground water atlas of the United States, Segment 1, California and Nevada: U.S. Geological Survey Hydrologic Investigations Atlas 730-B, 28 p.

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