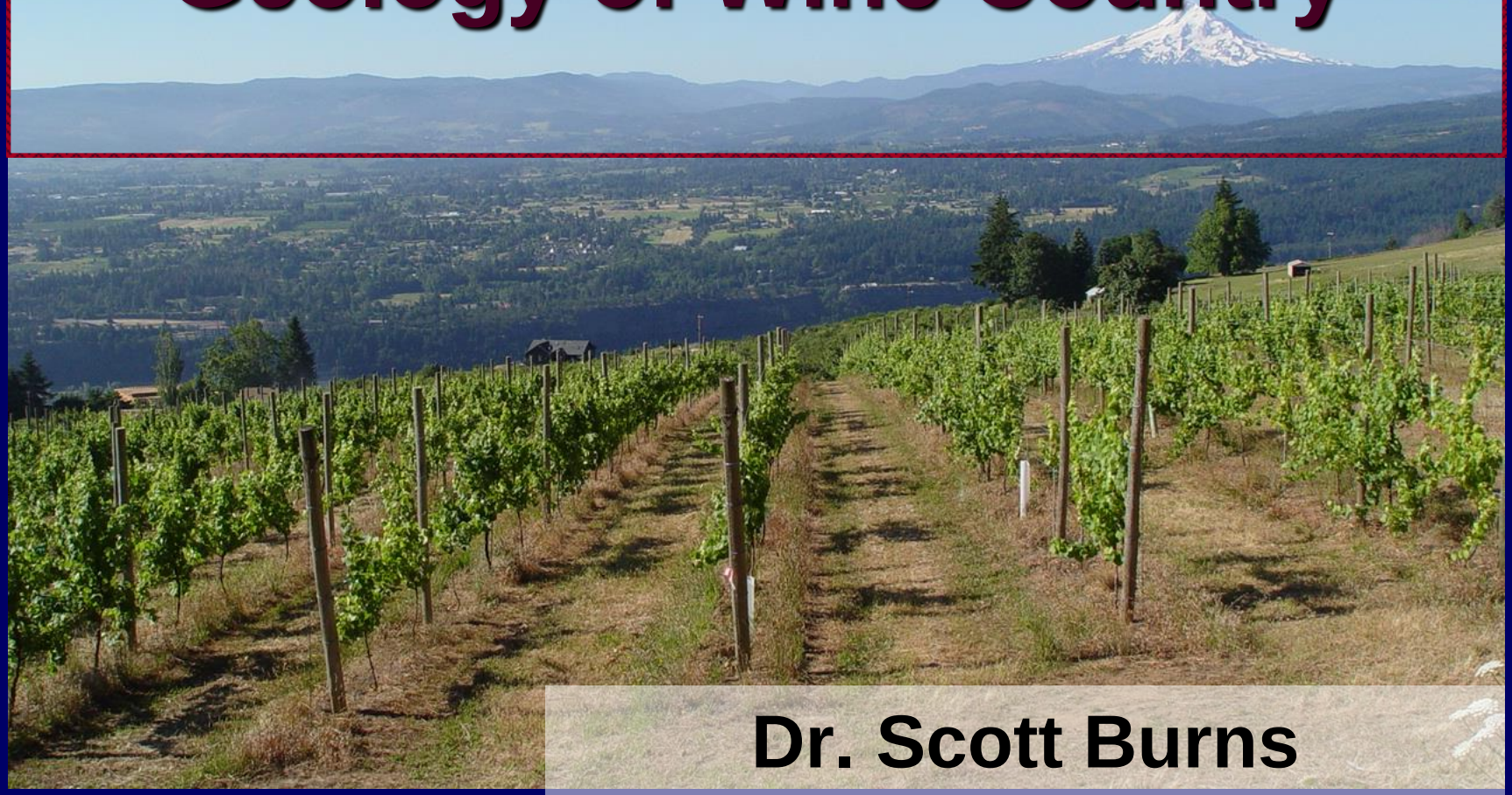
Oregon Rocks: Story of the Geology of Wine Country



Dr. Scott Burns

Portland State University, Portland Oregon

Ken Wright

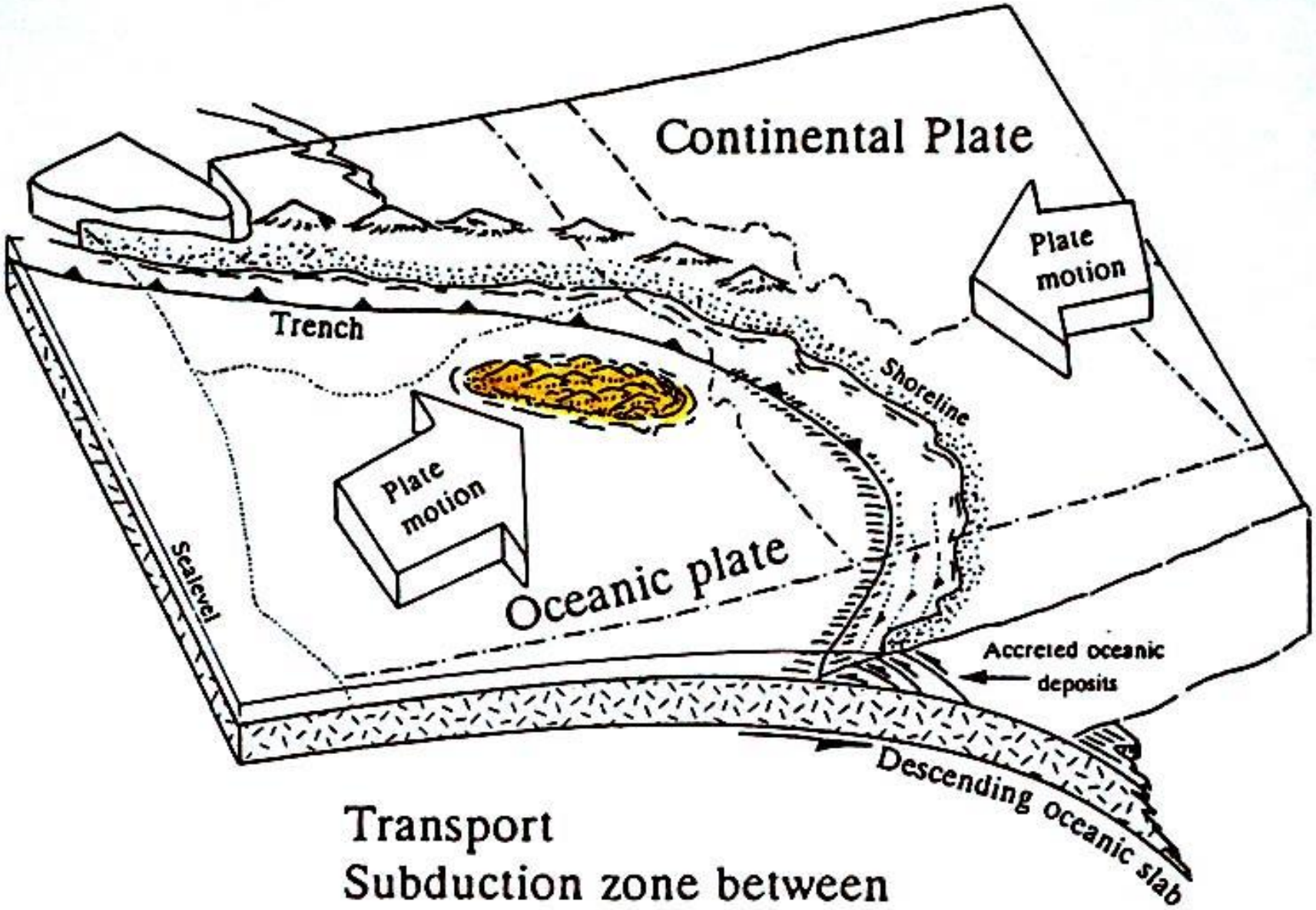
Wine Spectator Front Cover: “A Master of Pinot Noir in Oregon”

“To understand Oregon wines, is to understand Oregon geology”

One of first Oregon Winemakers to put the soil/geology on the wine label

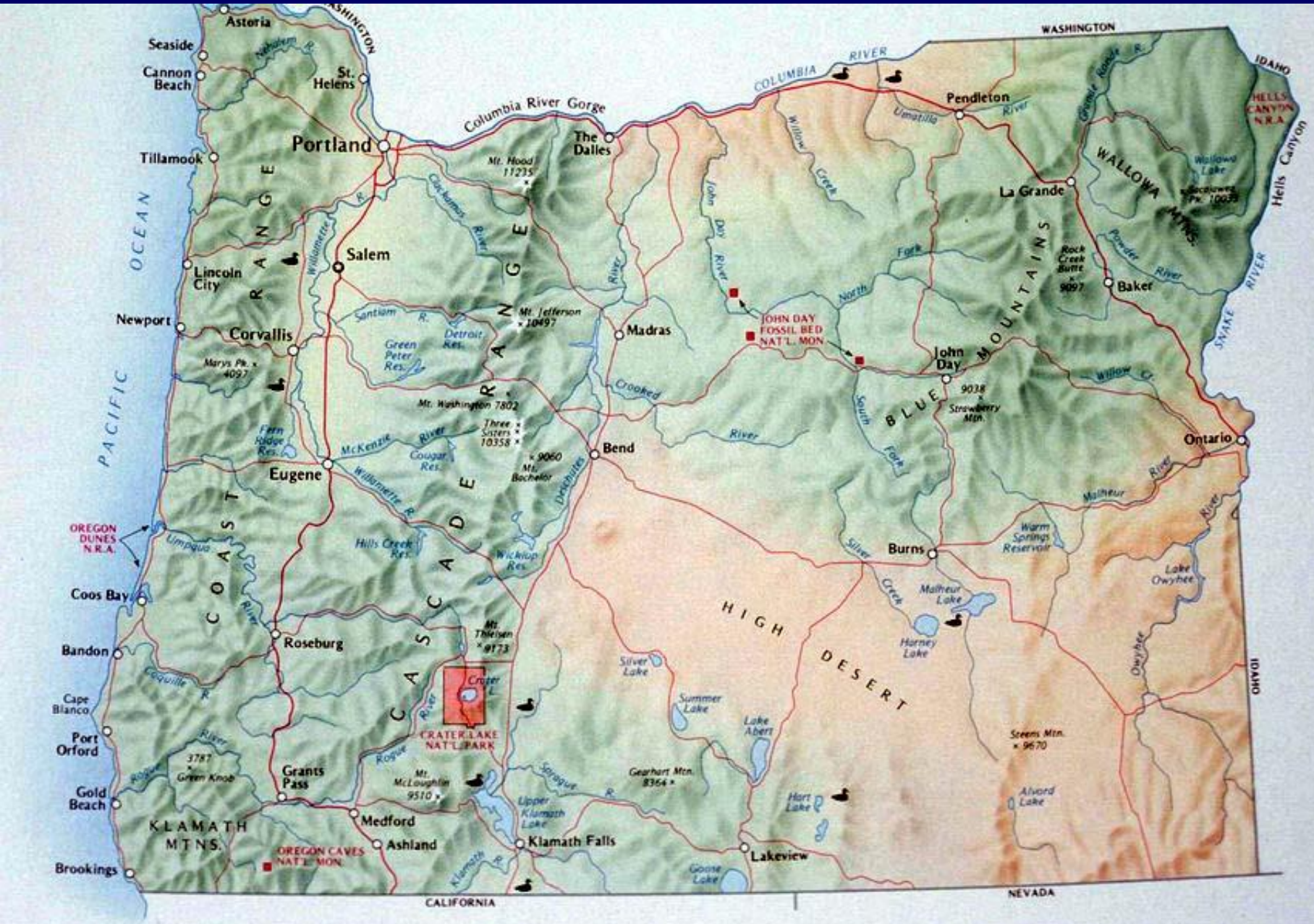
Celebrate Diversity!

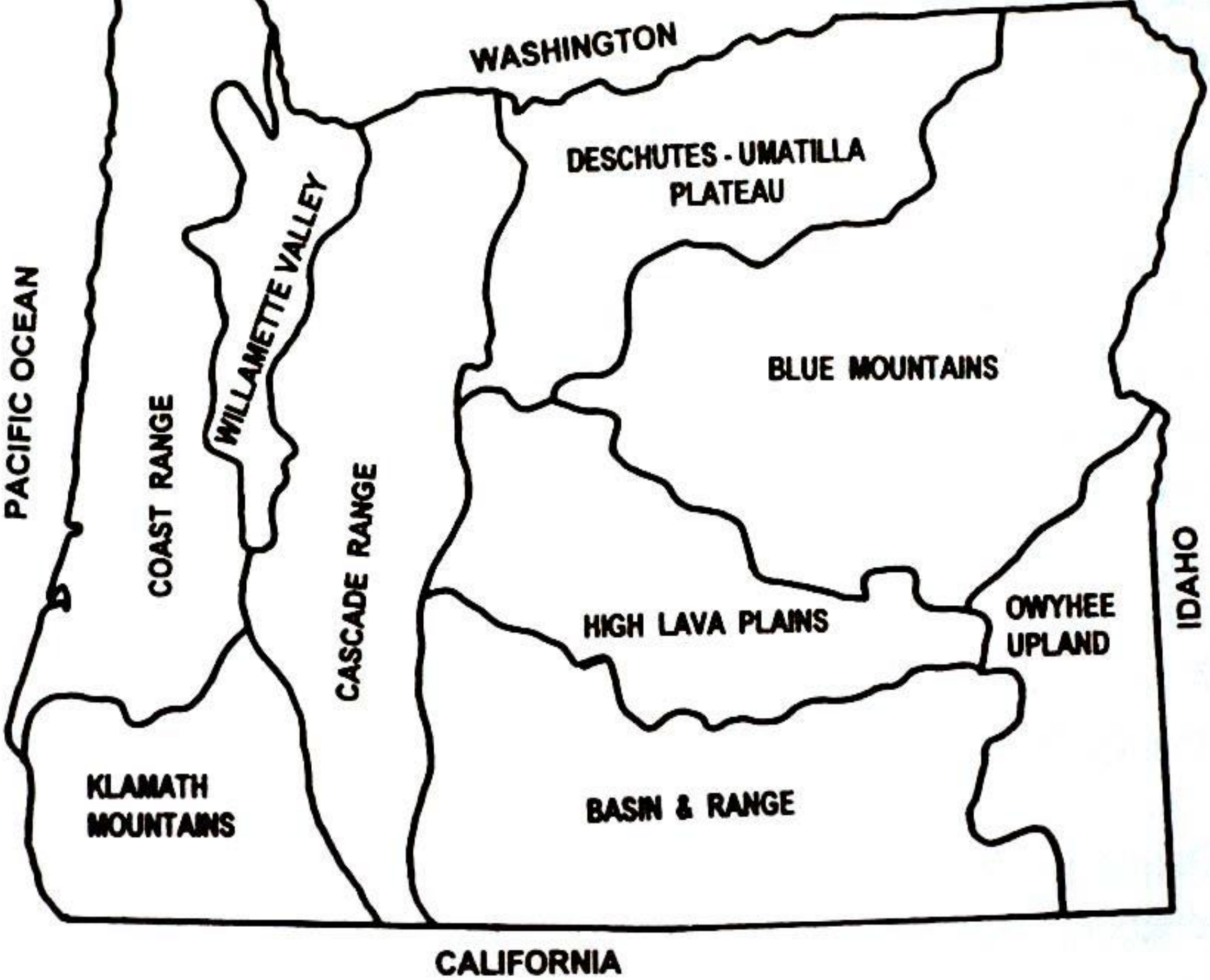
- Each Geological Unit/Soil Type gives its own expression of taste! Terroir!
- Willamette Valley – 4 geological units
- Gorge – 7 geological units
- Rocks of Milton Freewater – 1 geo. unit
- Umpqua – 5 geological units
- Rogue – 3 geological units
- Applegate – 2 geological units
- Illinois Valley – 2 geological units



Transport
Subduction zone between
continental block and mainland


Arctic Ocean
Eurasia
North America
Atlantic Ocean
Pacific Ocean
India
Africa
Equator
South America
Australia
60
30


Astoria
Seaside
Cannon Beach
Nehalem R.
St. Helens
Columbia River Gorge
COLUMBIA RIVER
WASHINGTON
IDAHO
Pendleton
Umatilla River
Grande Ronde R.
HELLS CANYON N.R.A.
Hells Canyon
Portland
The Dalles
Tillamook
Mt. Hood 11235
Willow Creek
John Day River
La Grande
WALLOWA MTS.
Wallowa Lake
Wallowa Pk. 10033
COAST RANGE
Clackamas River
Willamette R.
Salem
Lincoln City
OCEAN
Rock Creek Butte 9097
Powder River
Baker
Newport
Santiam R.
Mt. Jefferson 10497
Madras
JOHN DAY FOSSIL BED NAT'L. MON.
North Fork
BLUE MOUNTAINS
SNAKE RIVER
Corvallis
Green Peter Res.
Detroit Res.
Marys Pk. 4097
John Day
Crooked River
Mt. Washington 7802
Three Sisters 10358
9038 Strawberry Mtn.
Willow Cr.
South Fork
Fern Ridge Res.
McKenzie River
Cougar Res.
9060 Mt. Bachelor
Bend
Ontario
Eugene
Willamette R.
Deschutes
Malheur River
PACIFIC
OREGON DUNES N.R.A.
Umpqua River
Hills Creek Res.
Wickiup Res.
Warm Springs Reservoir
Burns
Silver Creek
Lake Owyhee
Malheur Lake
Coos Bay
CASCADE RANGE
HIGH DESERT
Mt. Thielsen 9173
Harney Lake
Bandon
Roseburg
Coquille R.
Silver Lake
Crater L.
Summer Lake
Owyhee
IDAHO
Cape Blanco
Port Orford
Rogue River
CRATER LAKE NAT'L. PARK
Lake Abert
Steens Mtn. 9670
3787 Green Knob
Grants Pass
Mt. McLoughlin 9510
Sprague R.
Gearhart Mtn. 8364
Hart Lake
Alvord Lake
Gold Beach
Upper Klamath Lake
Medford
KLAMATH MTNS.
Ashland
Klamath Falls
Lakeview
OREGON CAVES NAT'L. MON.
Brookings
Klamath R.
Goose Lake
CALIFORNIA
NEVADA


WASHINGTON
DESCHUTES - UMATILLA PLATEAU
WILLAMETTE VALLEY
PACIFIC OCEAN
COAST RANGE
CASCADE RANGE
BLUE MOUNTAINS
IDAHO
HIGH LAVA PLAINS
OWYHEE UPLAND
KLAMATH MOUNTAINS
BASIN & RANGE
CALIFORNIA

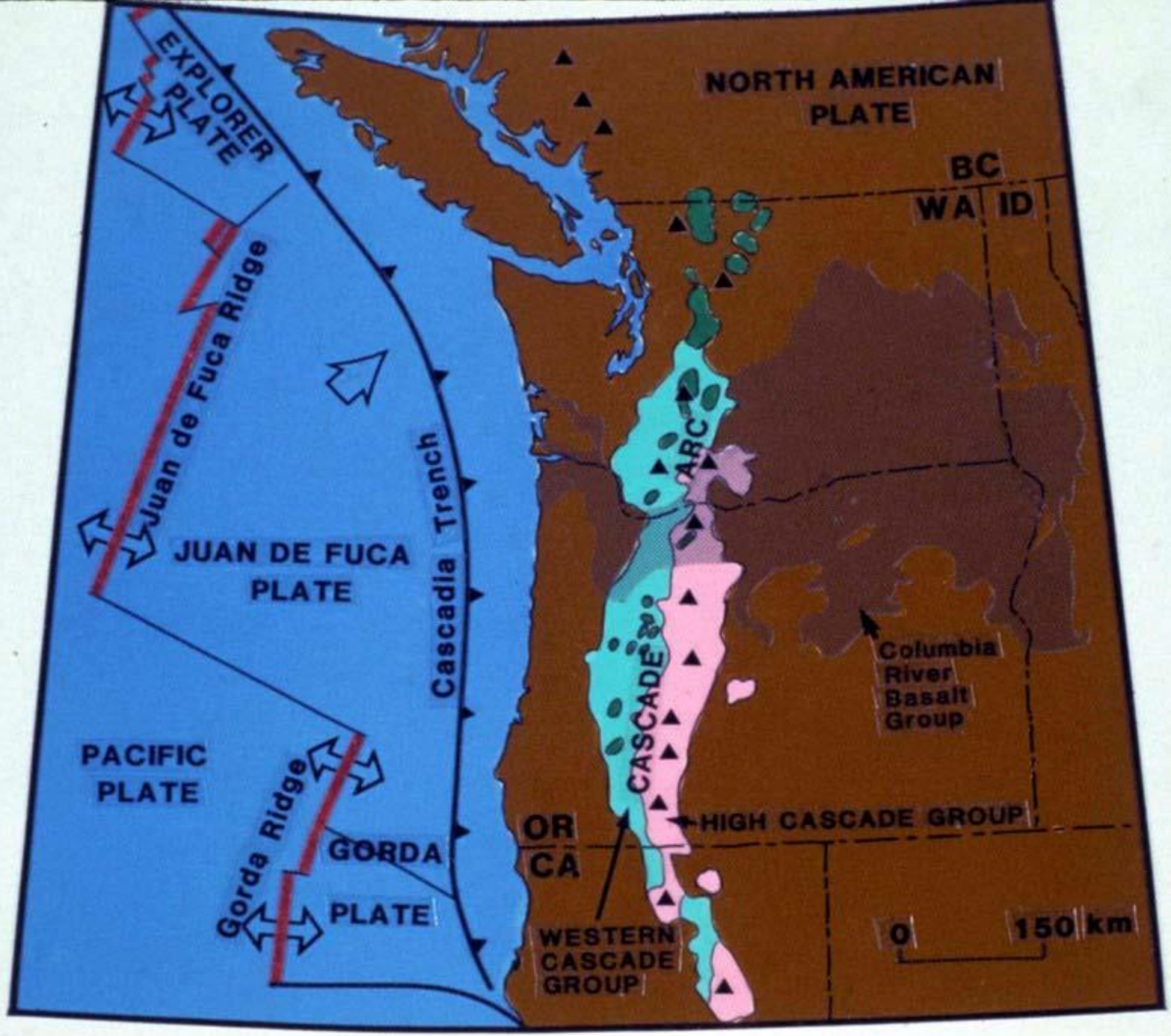
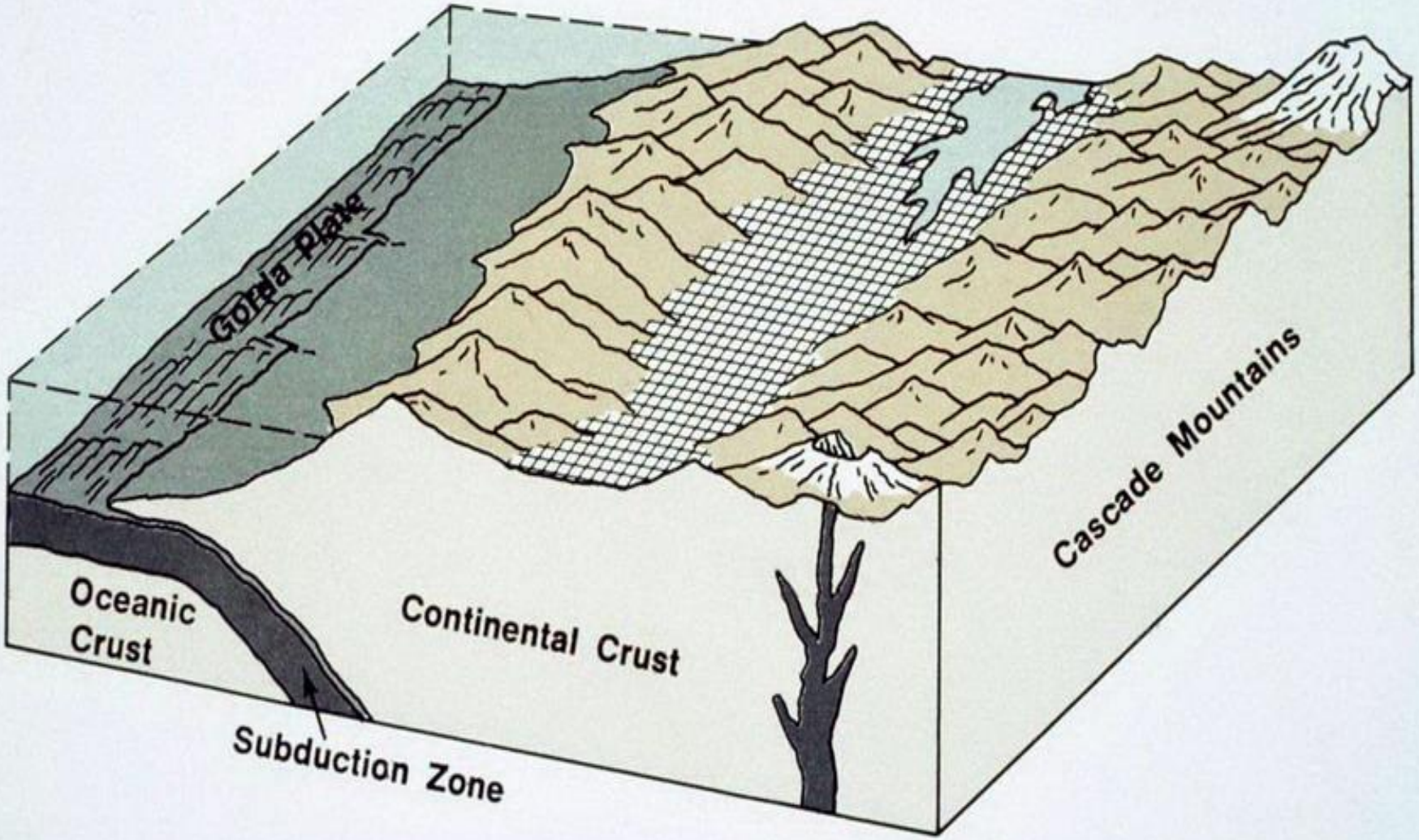
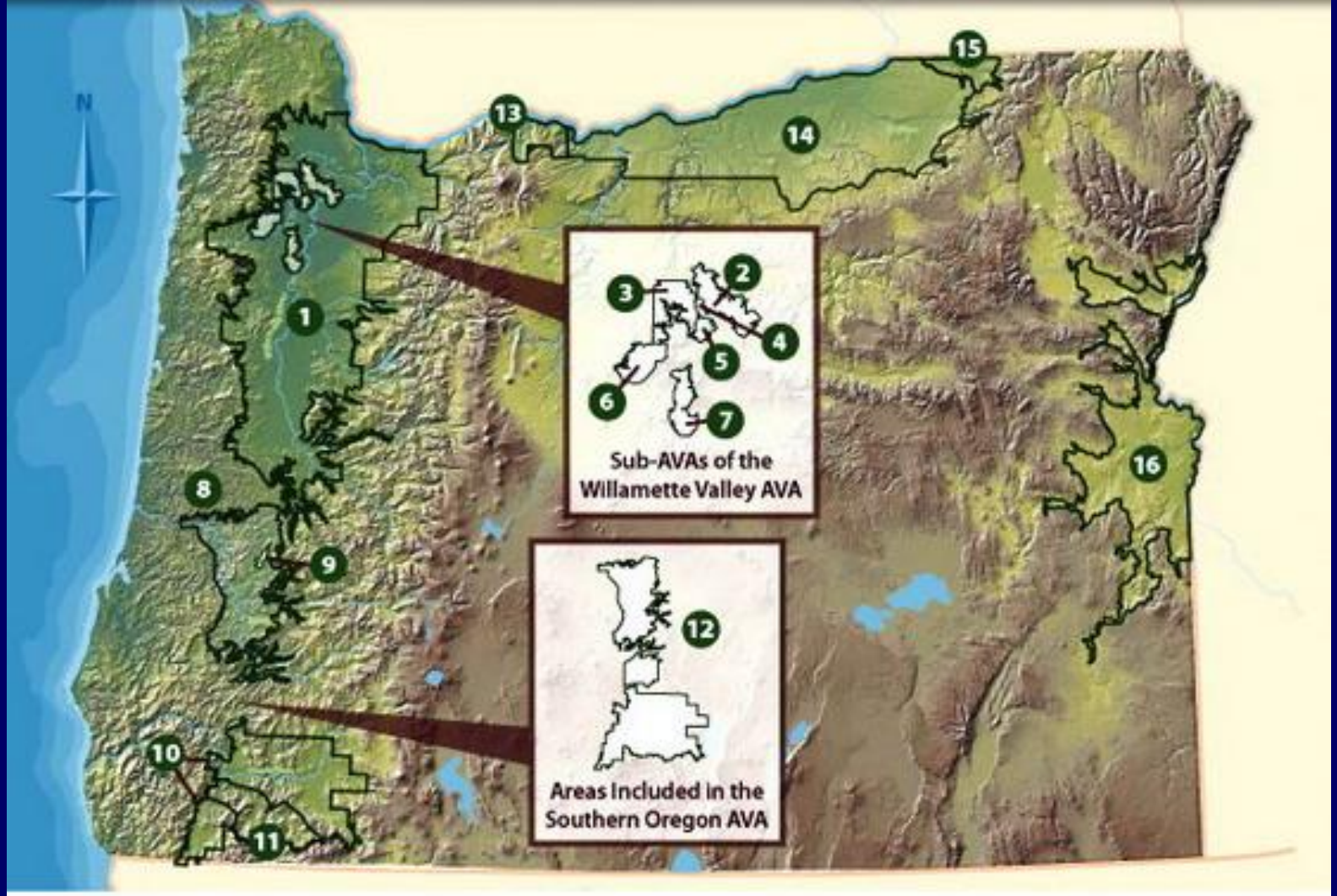

EXPLORER PLATE
NORTH AMERICAN PLATE
BC
WA
ID
Juan de Fuca Ridge
Cascadia Trench
JUAN DE FUCA PLATE
ARC
CASCADE
Columbia River Basalt Group
PACIFIC PLATE
Gorda Ridge
GORDA PLATE
HIGH CASCADE GROUP
OR
CA
WESTERN CASCADE GROUP
0
150 km

PLATE TECTONIC RELATIONSHIPS IN THE PACIFIC NORTHWEST





— AMERICAN VITICULTURAL AREAS OF OREGON —

1 Willamette Valley	5 Dundee Hills	9 Red Hills Douglas County	13 Columbia Gorge
2 Chehalem Mountains	6 McMinnville	10 Rogue Valley	14 Columbia Valley
3 Yamhill-Carlton District	7 Eola-Amity Hills	11 Applegate Valley	15 Walla Walla Valley
4 Ribbon Ridge	8 Umpqua Valley	12 Southern Oregon	16 Snake River Valley

Willamette Valley Geology

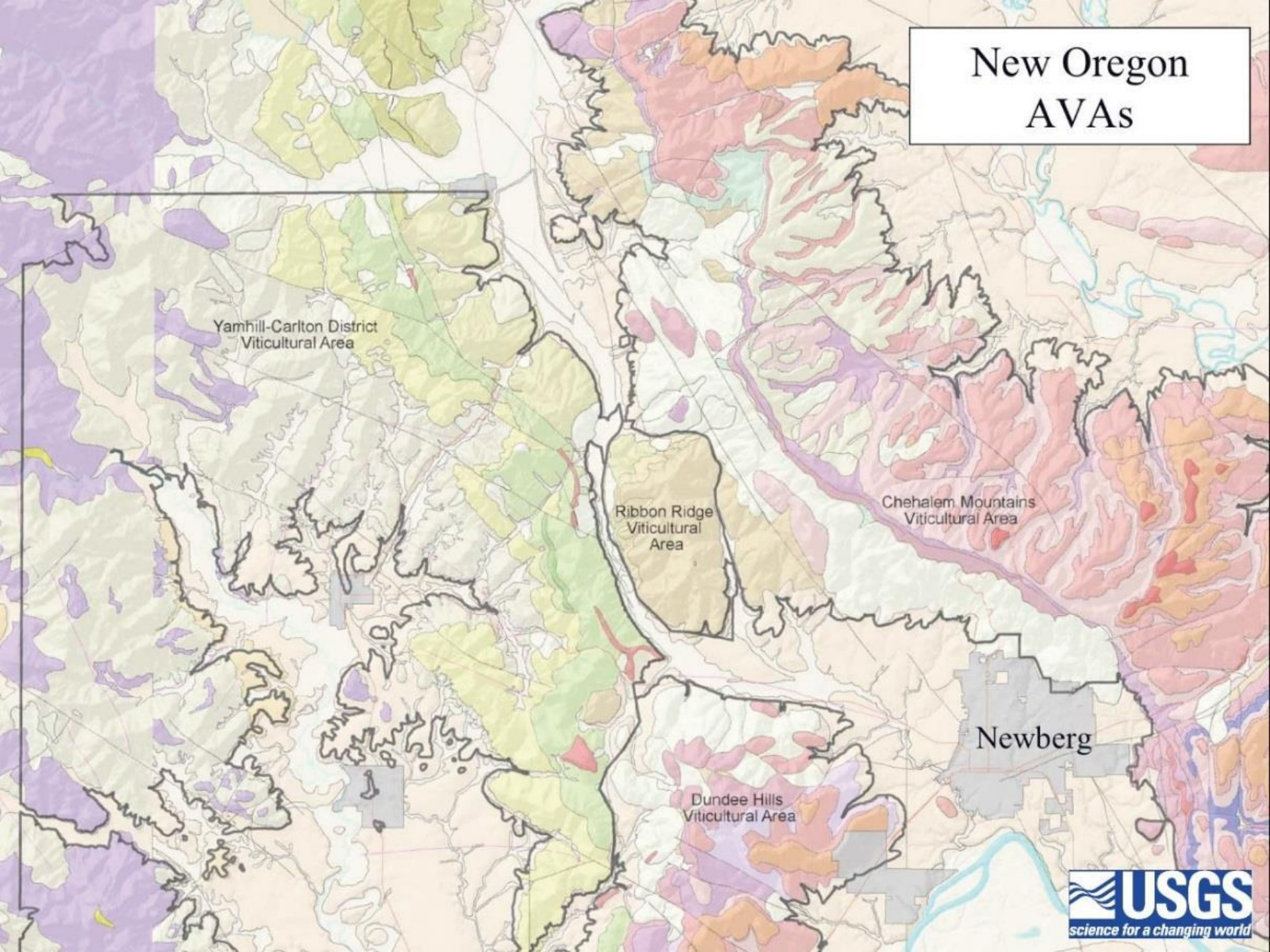
- Volcanic Bedrock (Columbia River Basalt and Jory/Nekia soils)
- Marine Sediments (sandstones & shales and Willakenzie & cousins soils)
- Volcanic with old loess (CRB, pisolites and Laurelwood soils)
- Missoula Flood Sediments (Woodburn soils and cousins)

Willamette Valley Parent Materials

- Volcanic Parent Material 41%
- Marine Sediment P.M. 30%
- Loess/Volcanic P.M. 20%
- Missoula Flood Sediments 9%

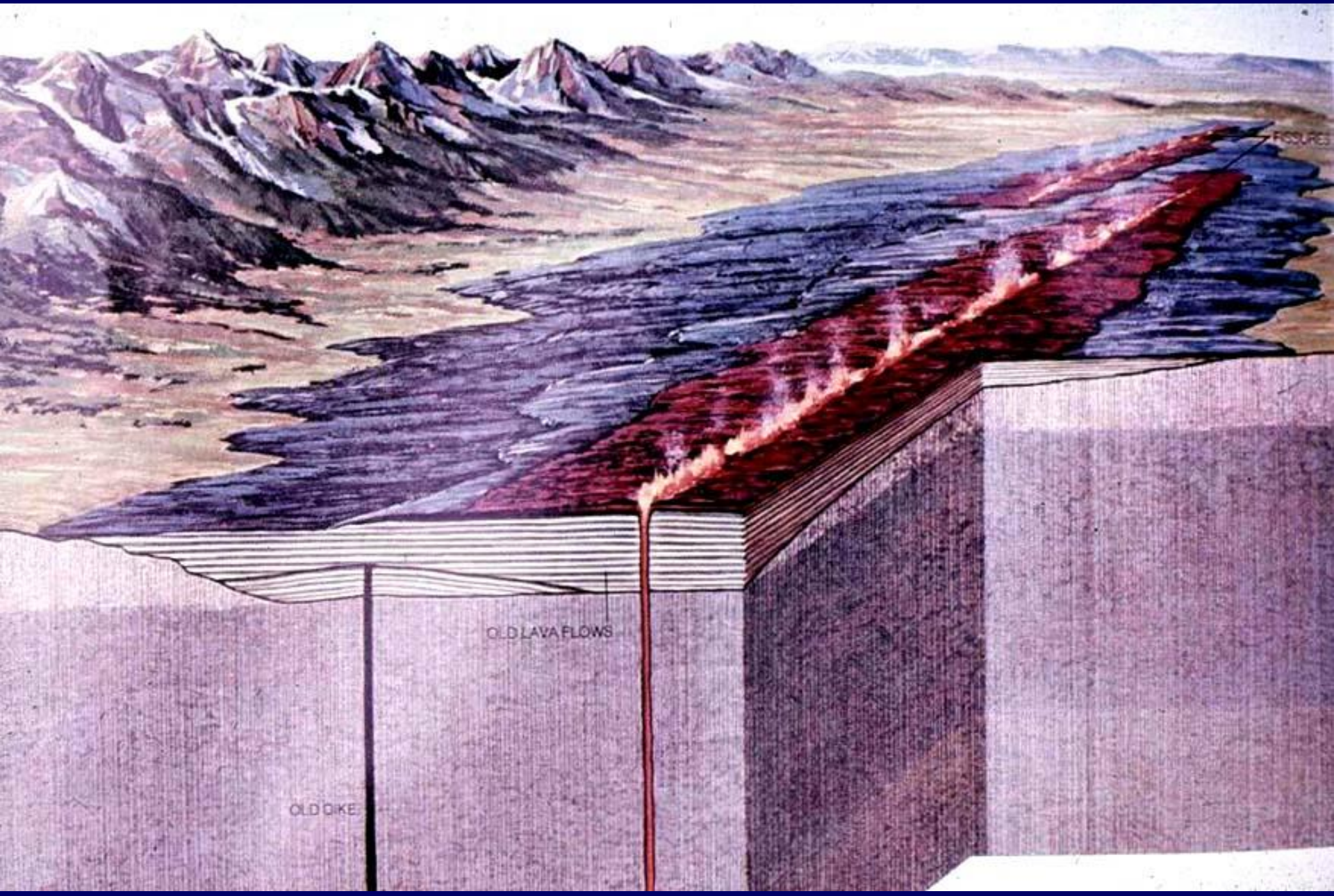
Willamette Valley Strategy

- Dry Land Farming so how to reduce vigor – use low nutrient soils (old soils on side slopes)
- Missoula Flood sediments have high nutrients so used less (also more frosts)
- Cool climate grapes – show terroir differences well – Riesling, Pinot Noir (thin skinned red grape), Chardonnay
- Sub-AVA's based on geology/soils

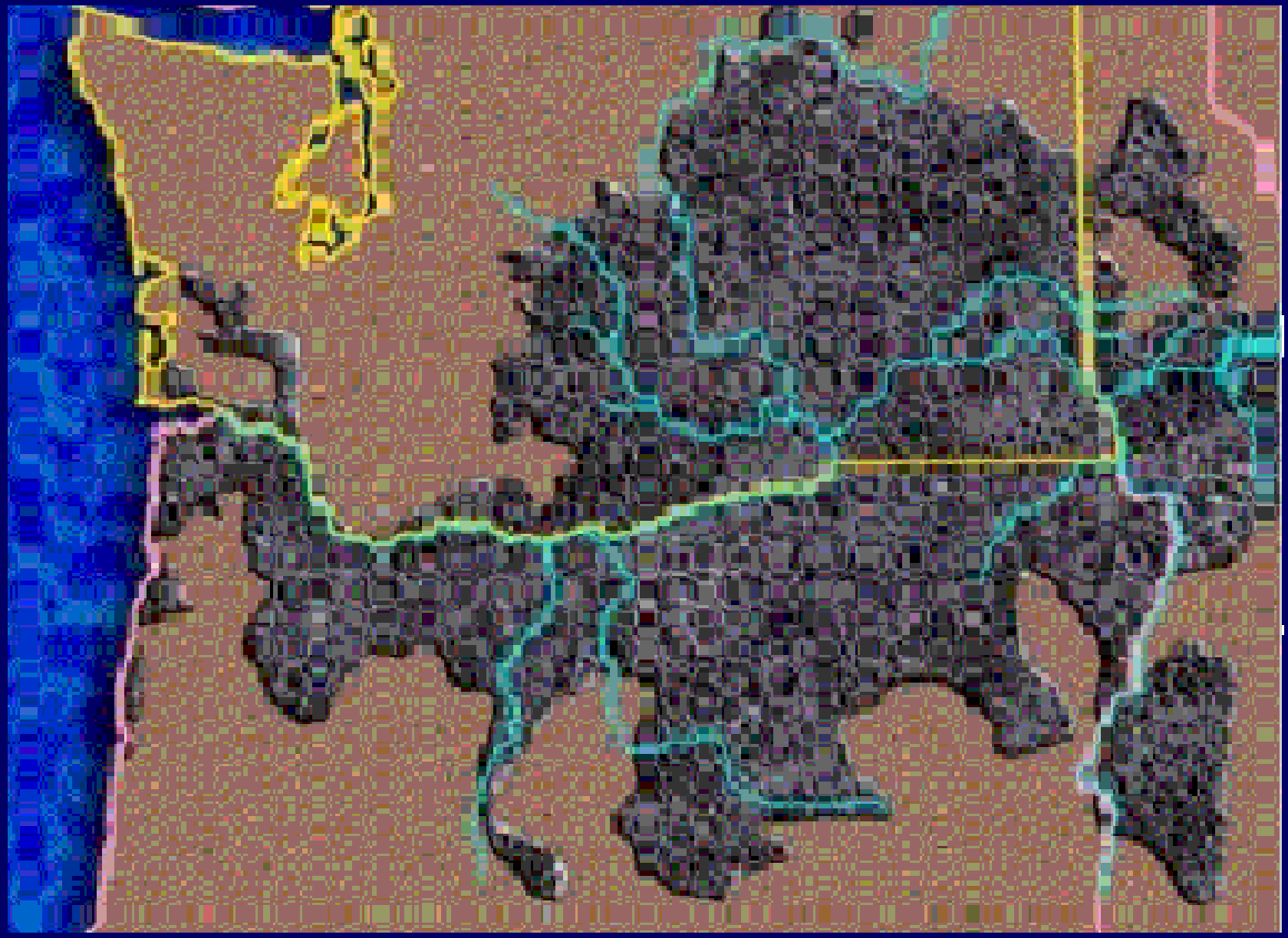

New Oregon AVAs
Yamhill-Carlton District Viticultural Area
Ribbon Ridge Viticultural Area
Chehalem Mountains Viticultural Area
Newberg
Dundee Hills Viticultural Area
USGS
science for a changing world

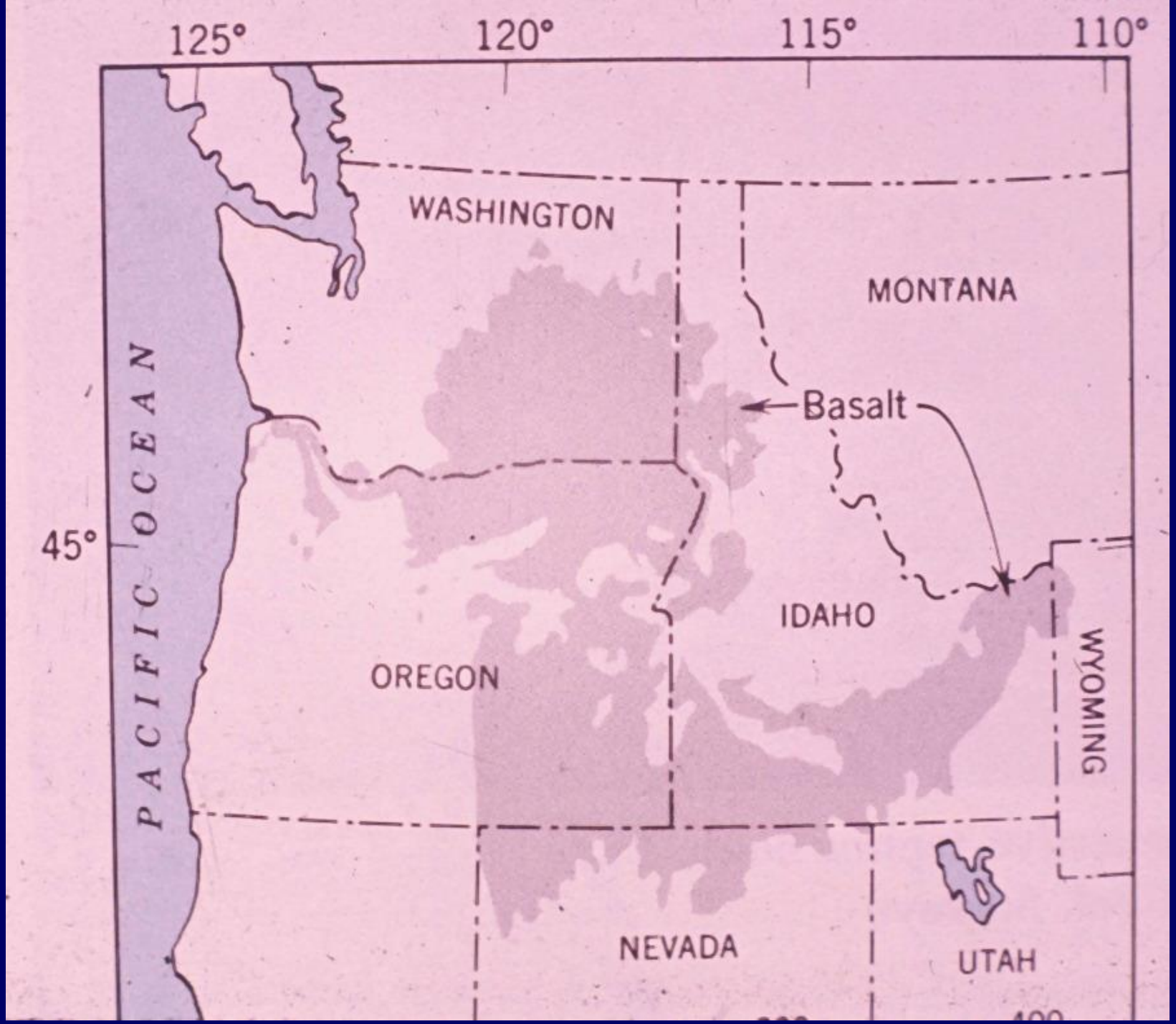
Volcanic Parent Material

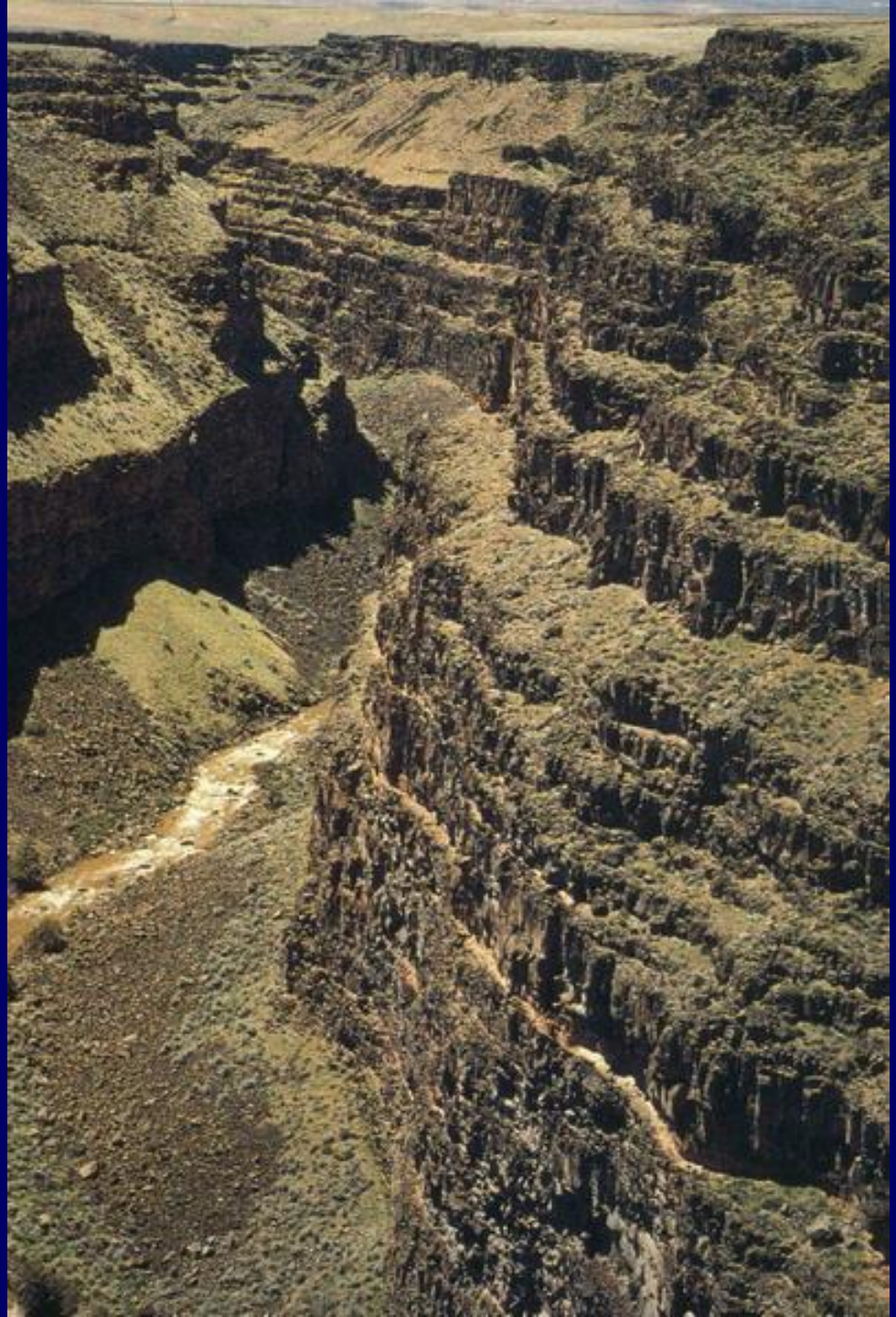
- Mainly Columbia River Basalt (17-6 Ma but 80% was 14-16 Ma) – Jory Soil
- One of World's greatest Volcanic Eruptions
- Some 2.4 Ma basalt south of Oregon City (Boring Lavas) – still Jory Soil


FISSURES
OLD LAVA FLOWS
OLD DIKE

Columbia River Basalt Distribution

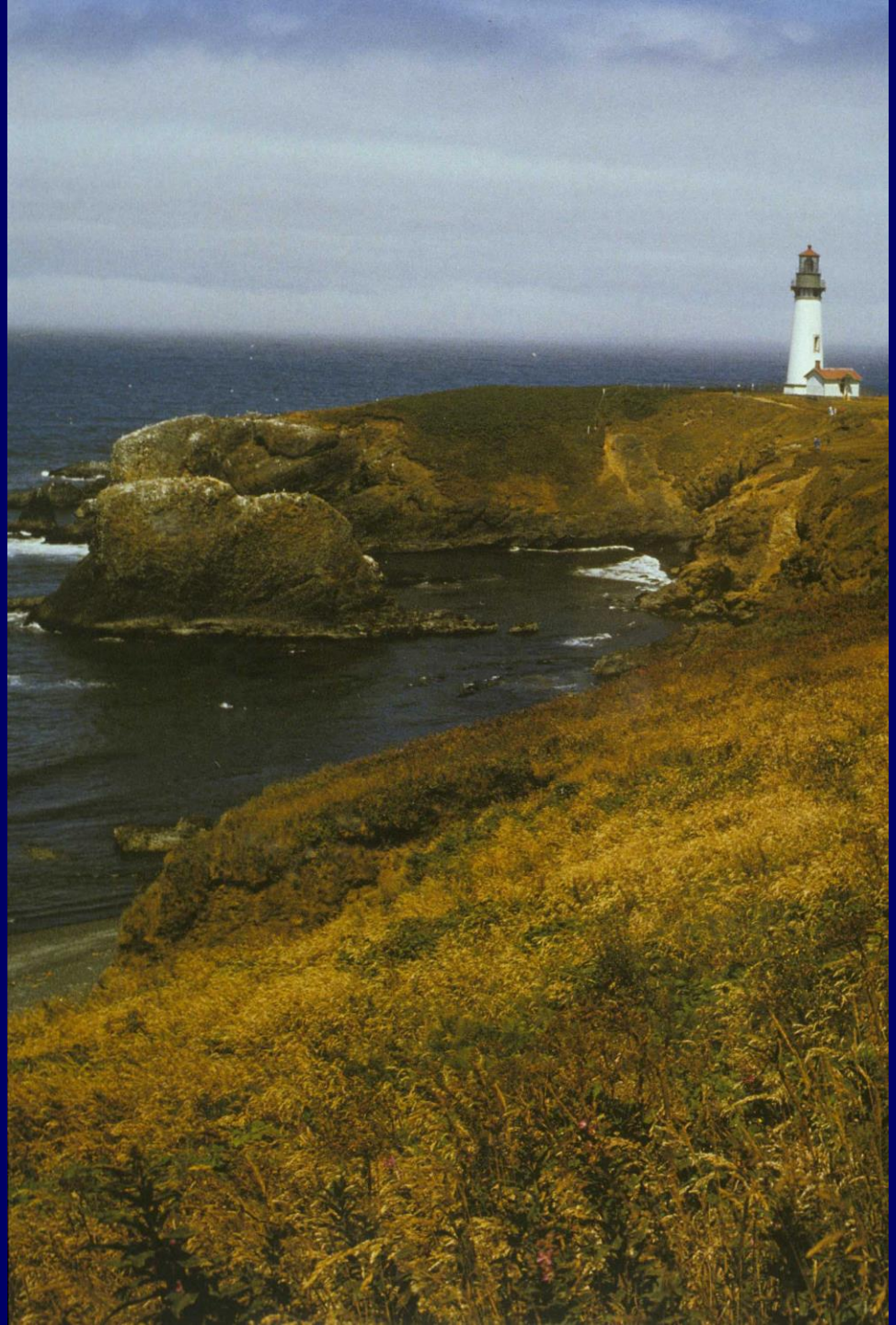



125°
120°
115°
110°
45°
PACIFIC OCEAN
WASHINGTON
MONTANA
Basalt
IDAHO
OREGON
WYOMING
NEVADA
UTAH

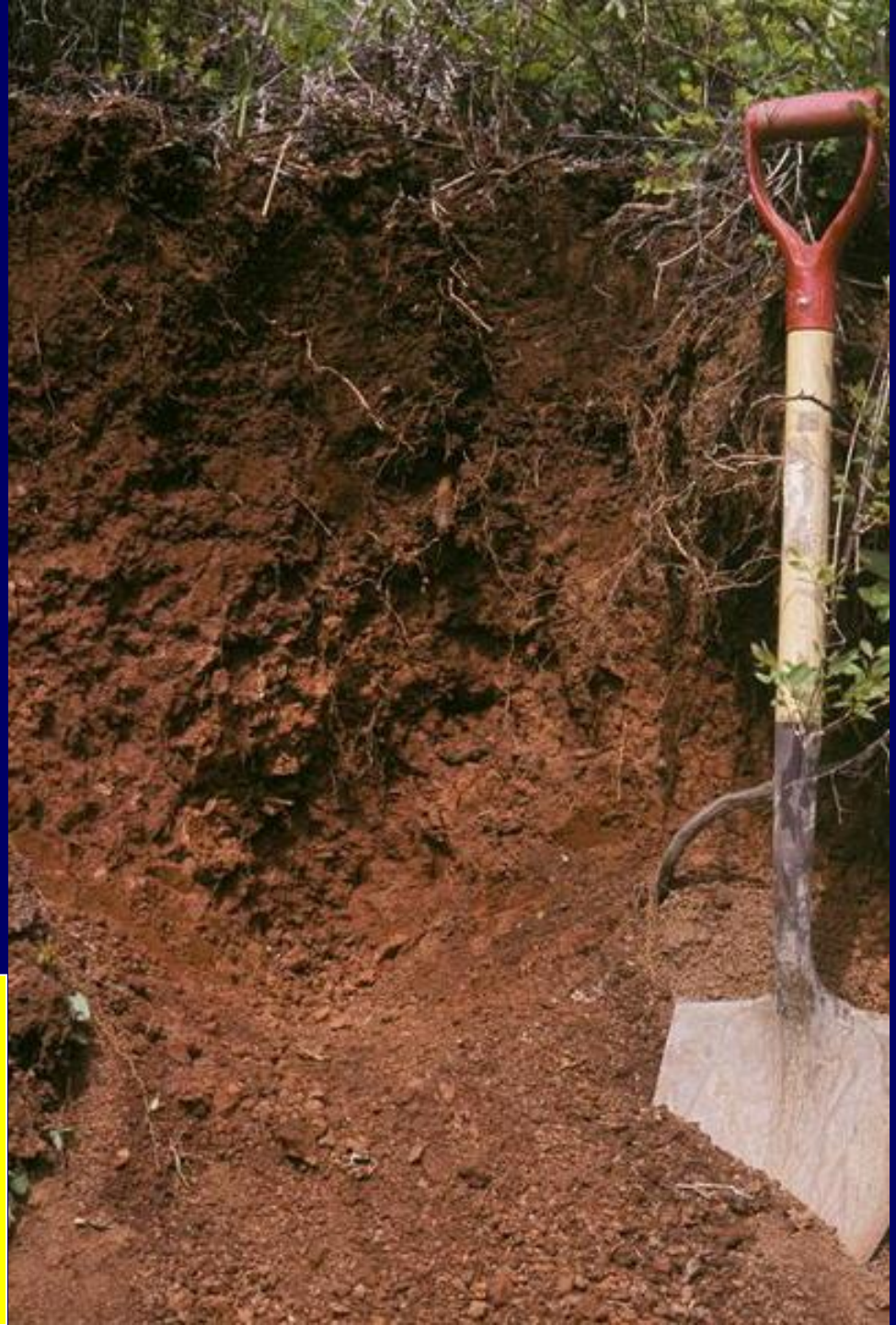


North Coast

Yaquina Head Lighthouse




Volcanic soils on the hills of Dundee, Oregon



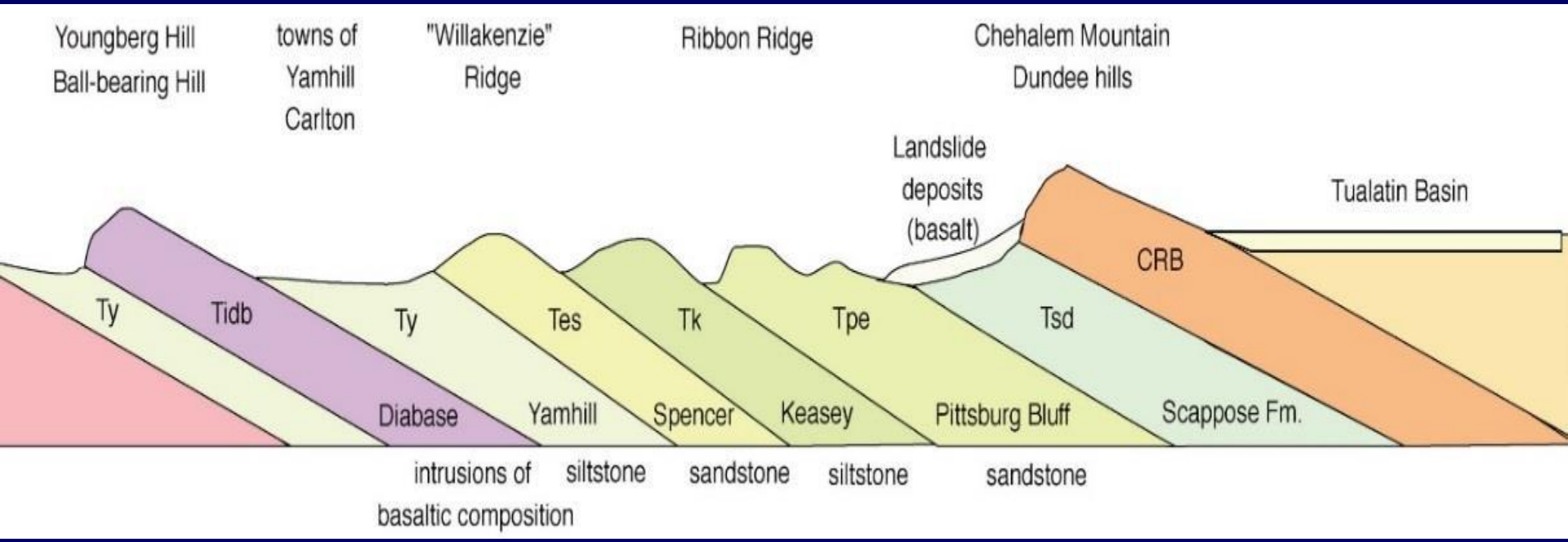
Jory Soil

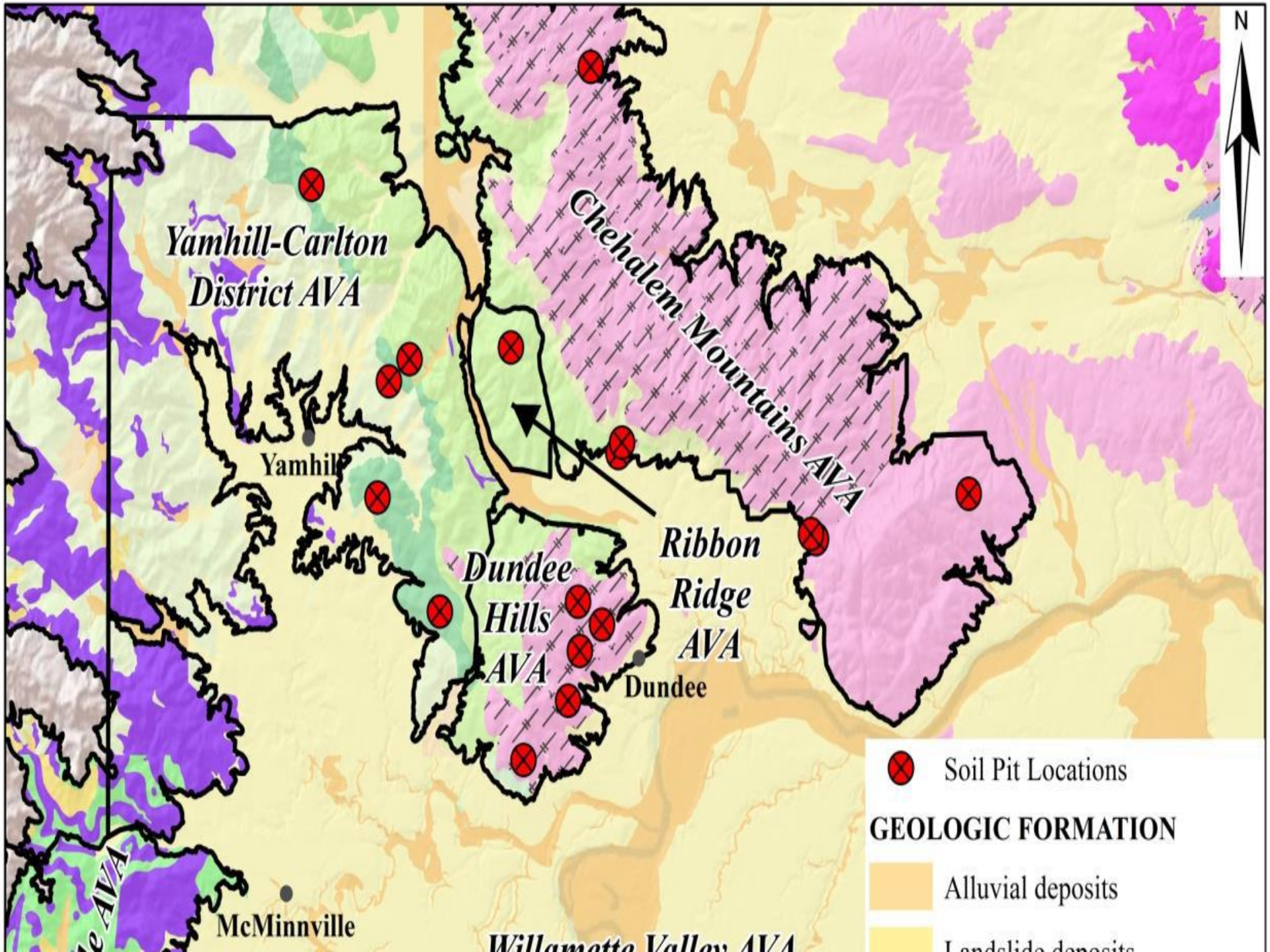
Basalt Bedrock

Oregon's State Soil

Marine Sediment Parent Material

- Uplifted ocean bottom from subduction of Juan de Fuca Plate
- Mainly sandstones and shales (no limestone which is produced in warm oceans)
- Soils seem to be more shallow than other parent materials (roots into bedrock faster)

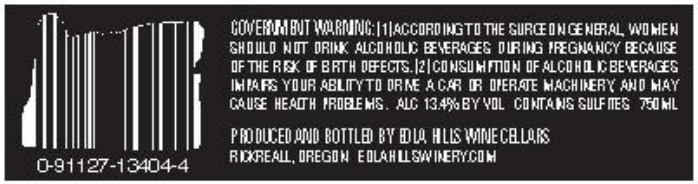

Youngberg Hill
Ball-bearing Hill
towns of
Yamhill
Carlton
"Willakenzie"
Ridge
Ribbon Ridge
Chehalem Mountain
Dundee hills
Landslide
deposits
(basalt)
Tualatin Basin
CRB
Ty
Tidb
Ty
Tes
Tk
Tpe
Tsd
Diabase
Yamhill
Spencer
Keasey
Pittsburg Bluff
Scappose Fm.
intrusions of
basaltic composition
siltstone
sandstone
siltstone
sandstone


N
Yamhill-Carlton District AVA
Chehalem Mountains AVA
Yamhill
Dundee Hills AVA
Ribbon Ridge AVA
Dundee
McMinnville
Willamette Valley AVA
Soil Pit Locations
GEOLOGIC FORMATION
Alluvial deposits
Landslide deposits


m
0·2
0·4
0·6
0·8
1·0
1·2
Aliette Vineyard,
Willakenzie Winery

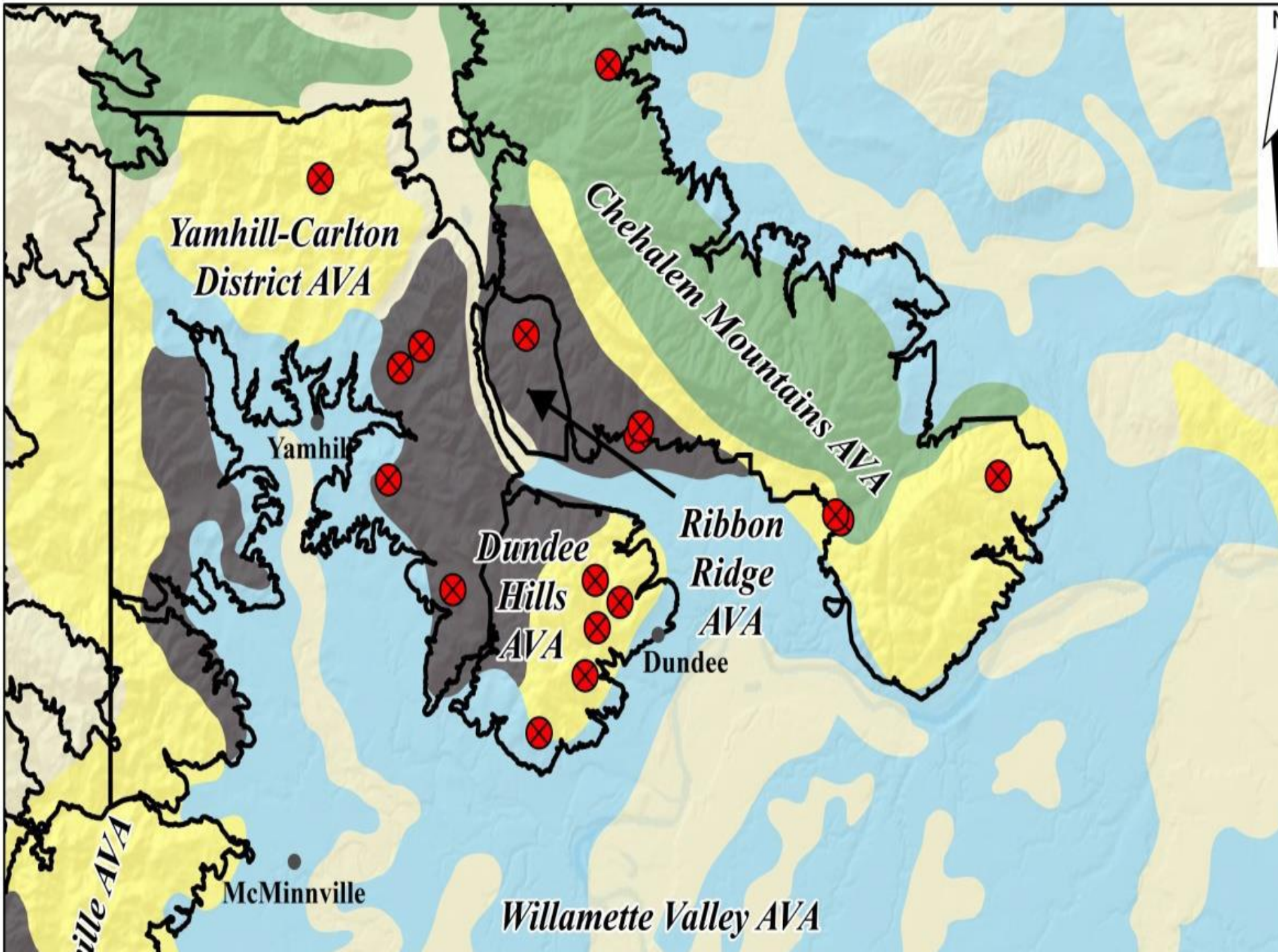
Marine Sediments, Willakenzie Winery

Eola Hills Wine Cellar Block



Volcanic plus old loess parent material

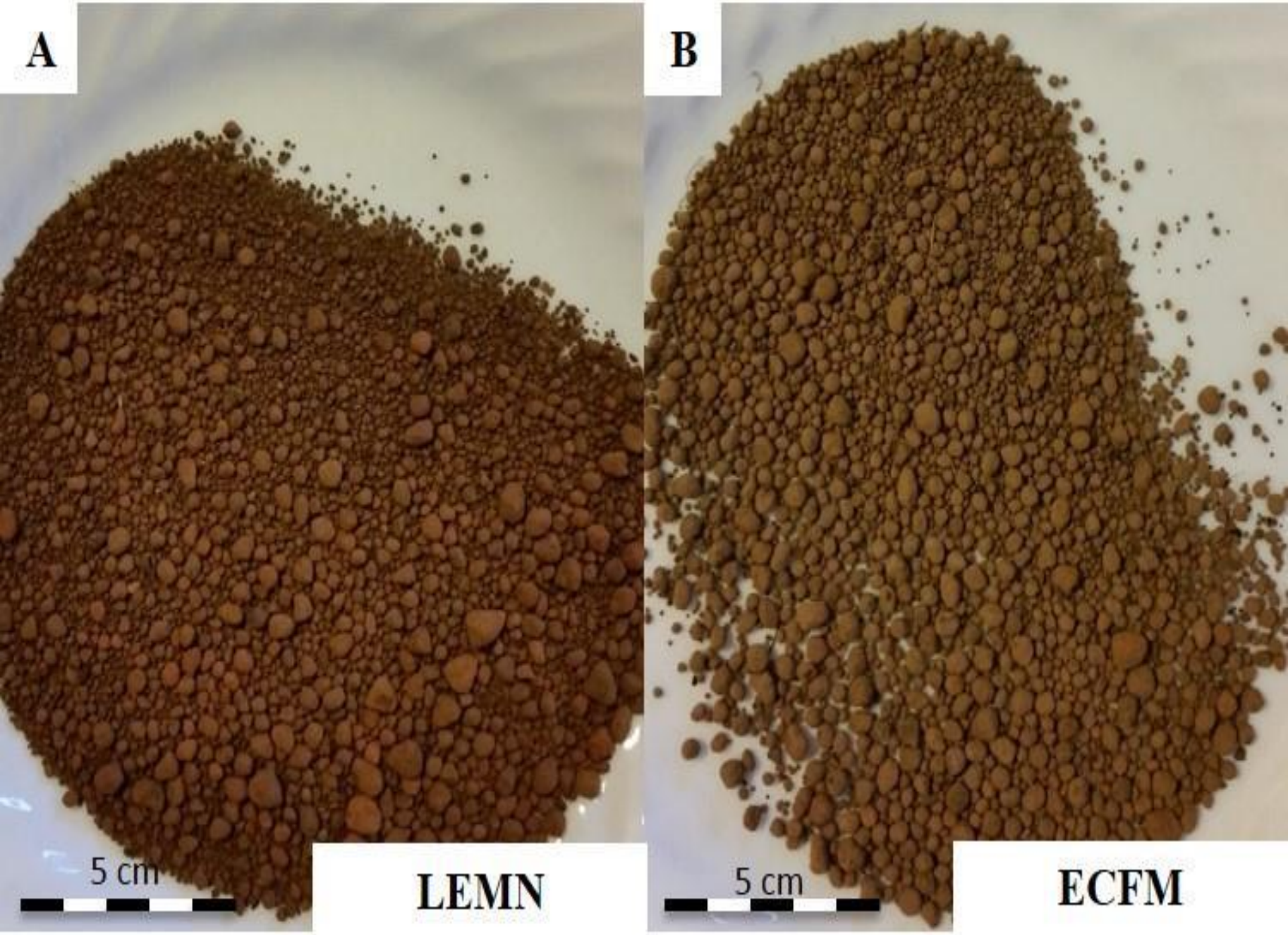
- Bedrock is mainly Columbia River Basalt
- Loess deposited before 100,000 years ago has been bioturbated into the soils (some places a layer on the surface); source is floodplain silt from last 2.6 million years
- Formed pisolites – iron-silica-magnesium concretions (“shot soils”)


Yamhill-Carlton
District AVA
Chehalem Mountains AVA
Yamhill
Ribbon
Ridge
AVA
Dundee
Hills
AVA
Dundee
McMinnville
Willamette Valley AVA

Loess:

Beware of the Fragipan

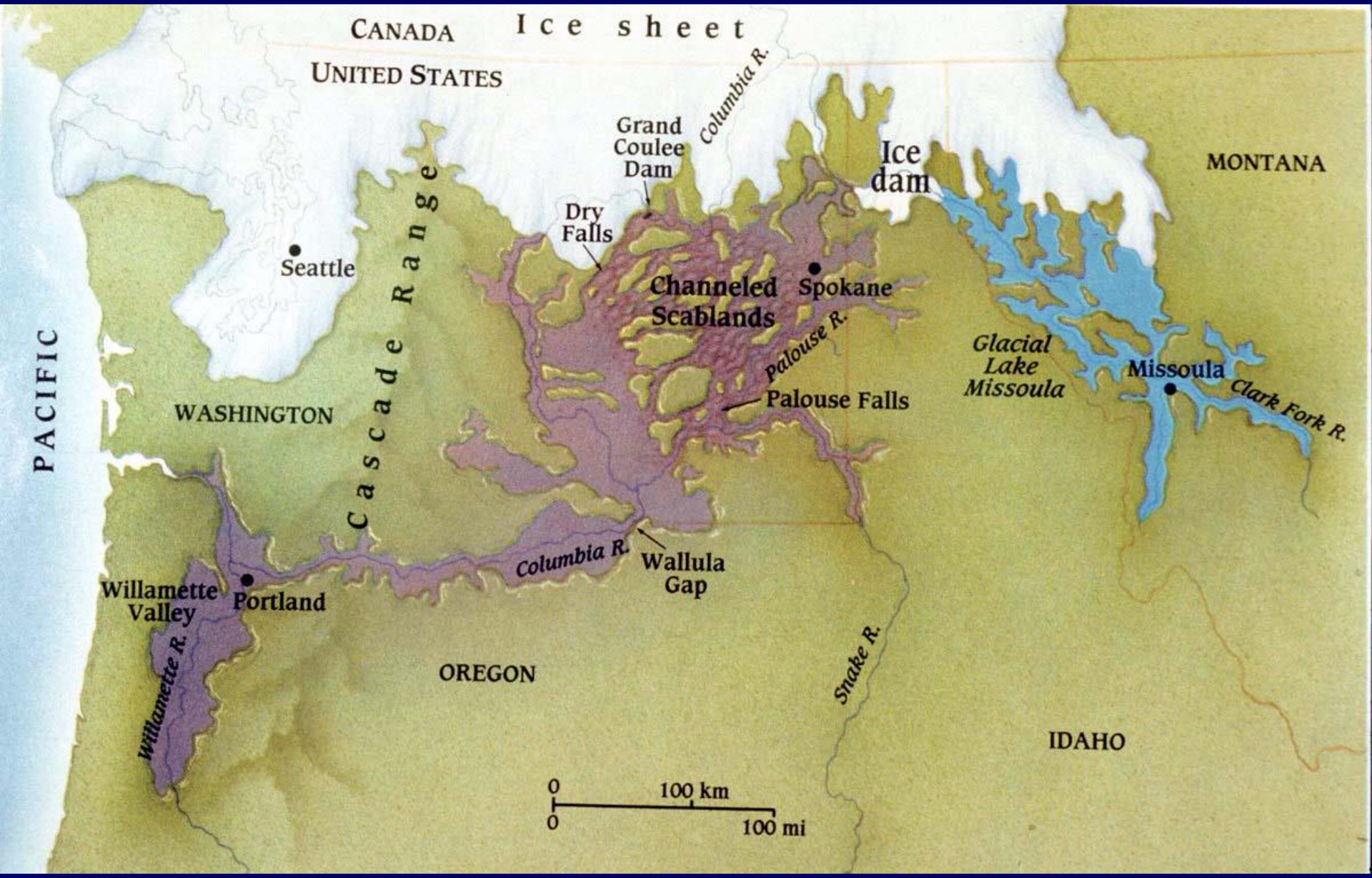
Five Mountain Vineyard

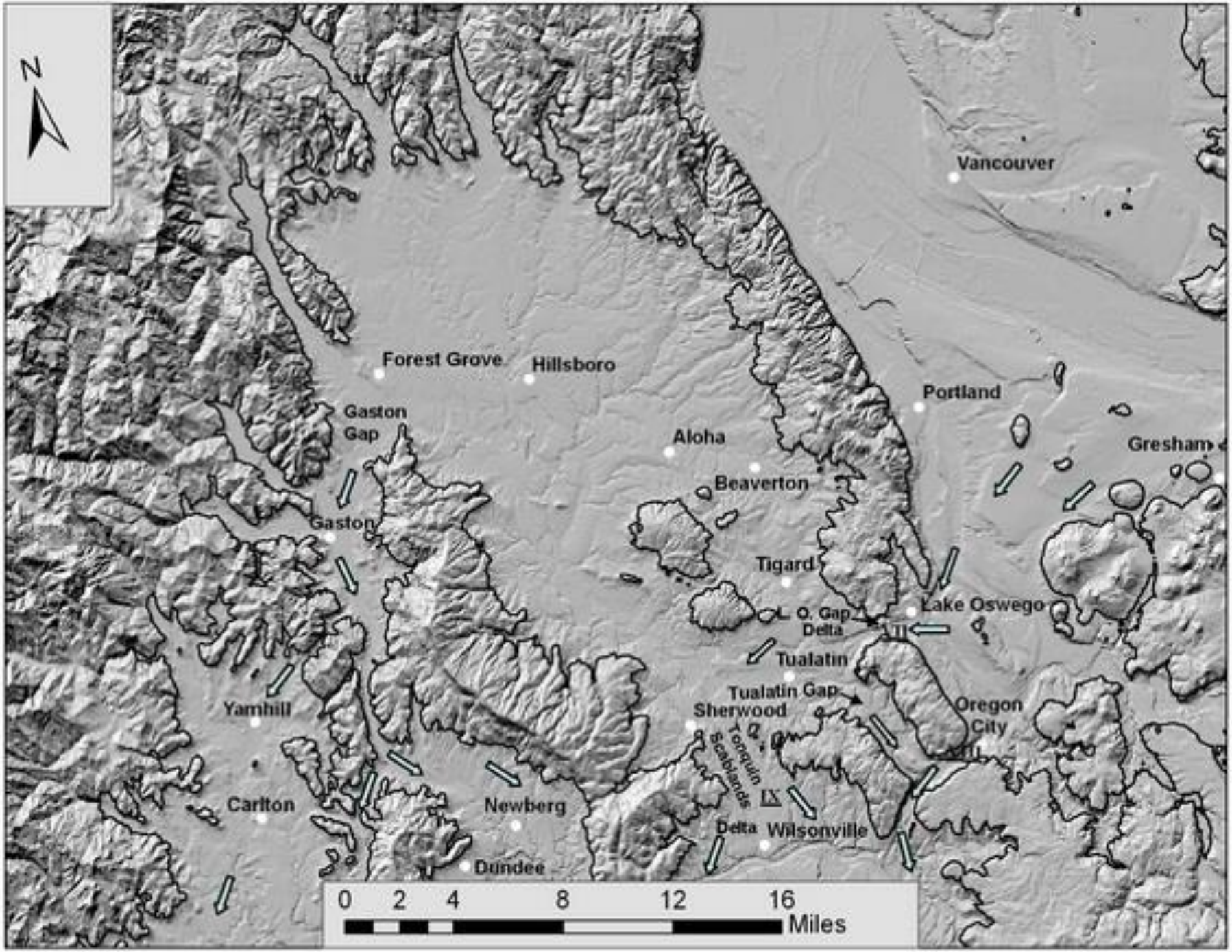

A
5 cm
LEMN
B
5 cm
ECFM


Landslide
Jacob Hart
Vineyard, Rex
Hill Winery

Missoula Floods

- 40 Major floods made it to Portland area
- Floods eroded and deposited sediments all over the Portland area – created topography; tan color soils
- Ages: 15,000-18,000 years BP
- Ancient Cataclysmic Floods similar – the earlier parts of the last 2.6 million years
- Coarse-Grained: Alameda Ridge, Mill Plain
- Fine-Grained: rhythmites in slackwater

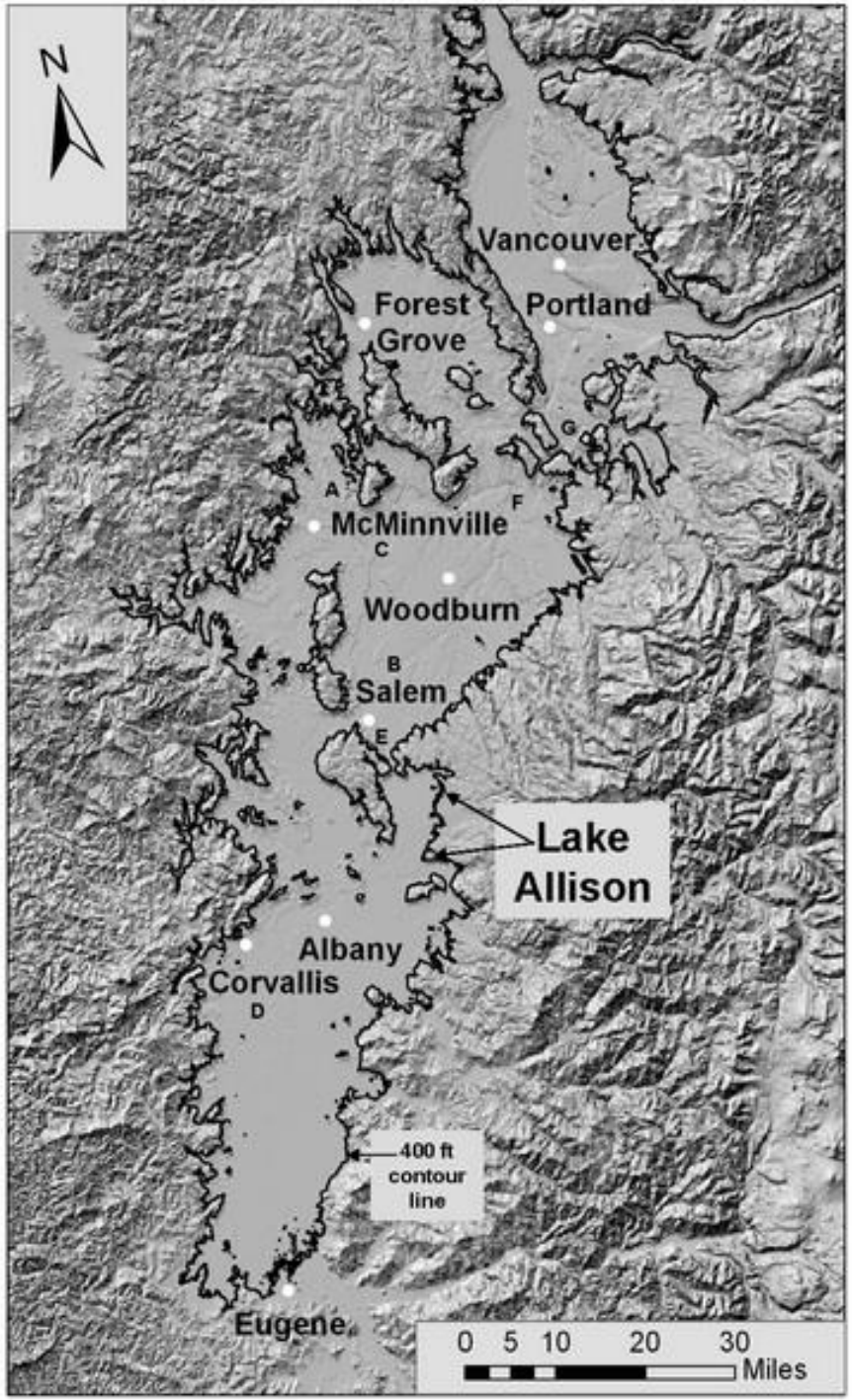

CANADA
Ice sheet
UNITED STATES
Columbia R.
Grand Coulee Dam
Ice dam
MONTANA
Dry Falls
Seattle
Cascade Range
Channeled Scablands
Spokane
Palouse R.
Glacial Lake Missoula
Missoula
Clark Fork R.
PACIFIC
WASHINGTON
Palouse Falls
Columbia R.
Wallula Gap
Willamette Valley
Portland
Willamette R.
OREGON
Snake R.
IDAHO
0
100 km
0
100 mi

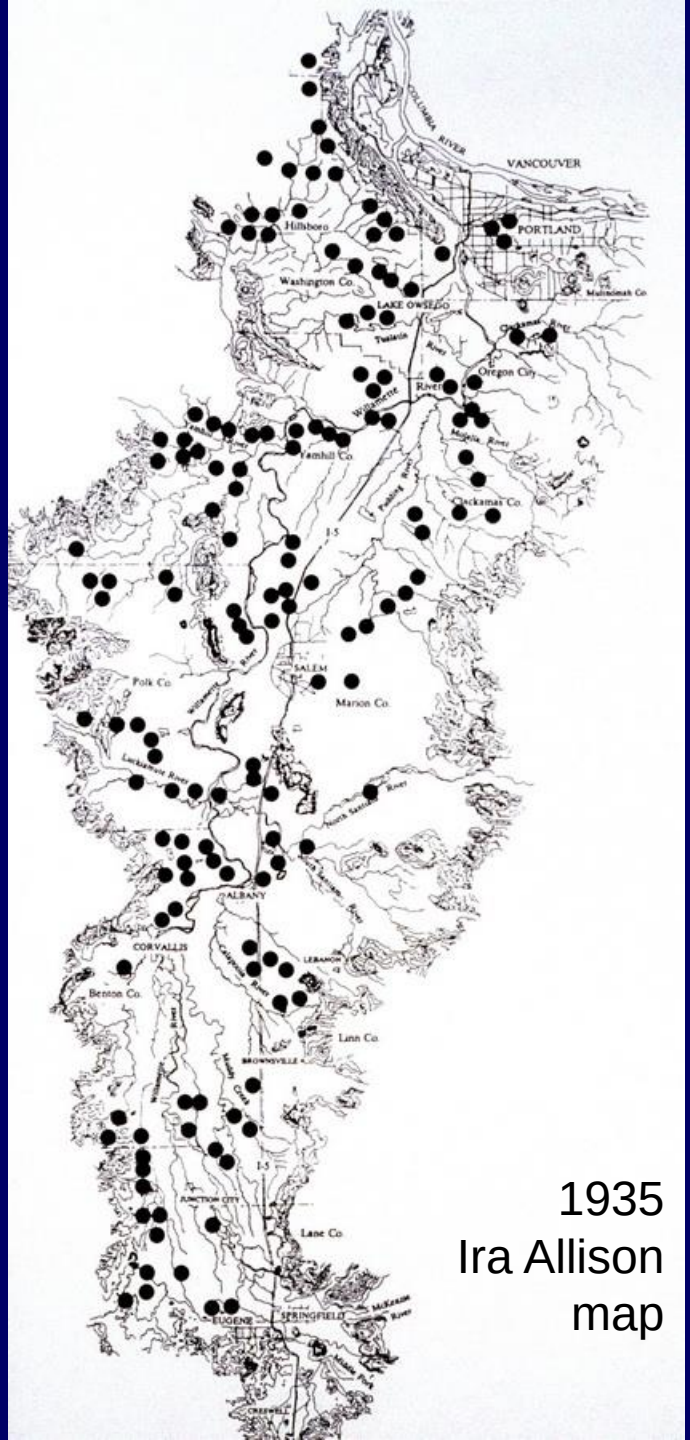

N
Vancouver
Forest Grove
Hillsboro
Portland
Gaston
Gap
Aloha
Gresham
Beaverton
Gaston
Tigard
Lake Oswego
O. Gap
Delta
Tualatin
Tualatin Gap
Yamhill
Sherwood
Oregon
City
Tonquin
Scablands
Carlton
Newberg
Delta
Wilsonville
Dundee
0 2 4 8 12 16
Miles

High radon: Alameda Ridge and Mill Plain Ridge

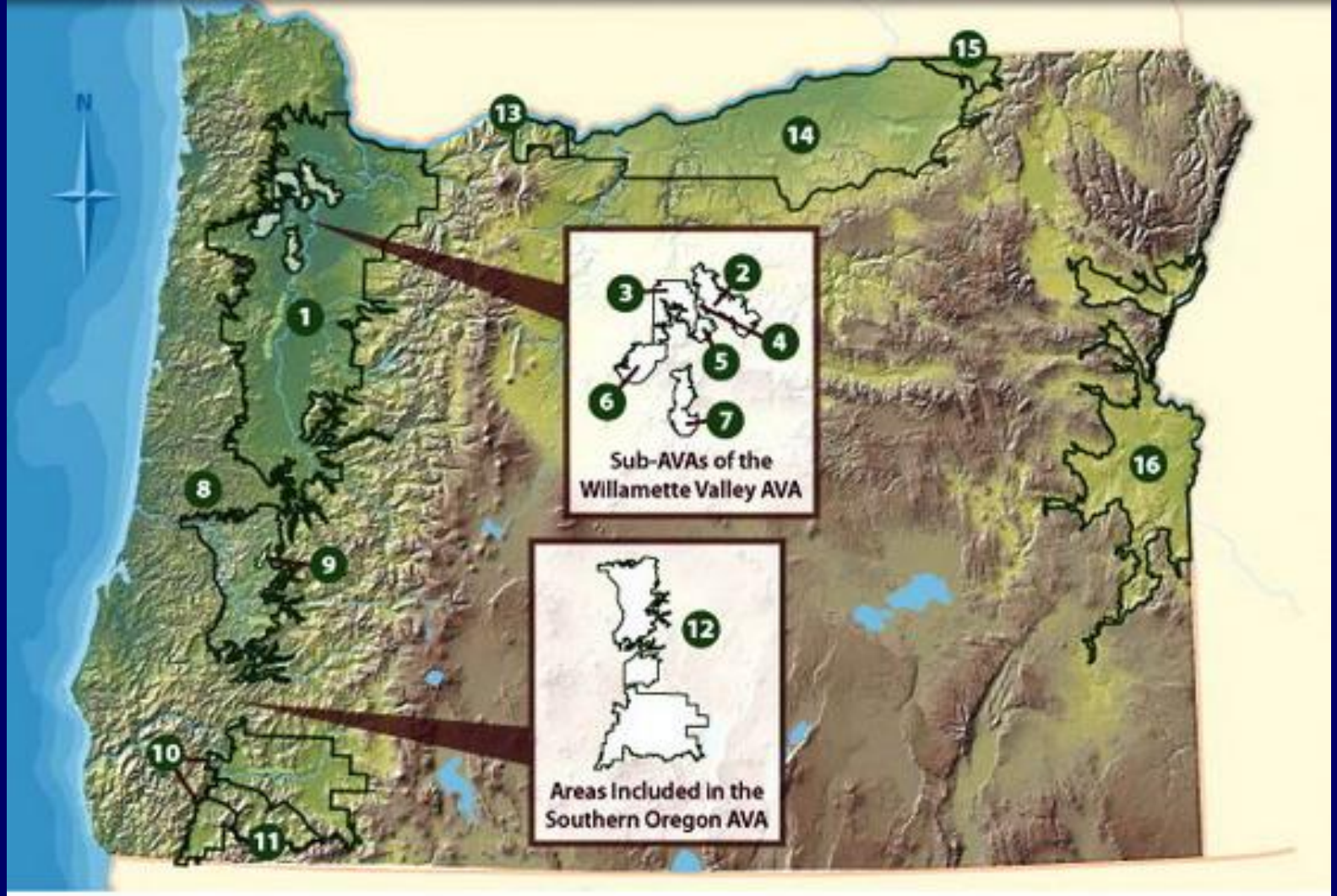
If the Missoula Floods were to occur today

Swan Island





1935
Ira Allison
map



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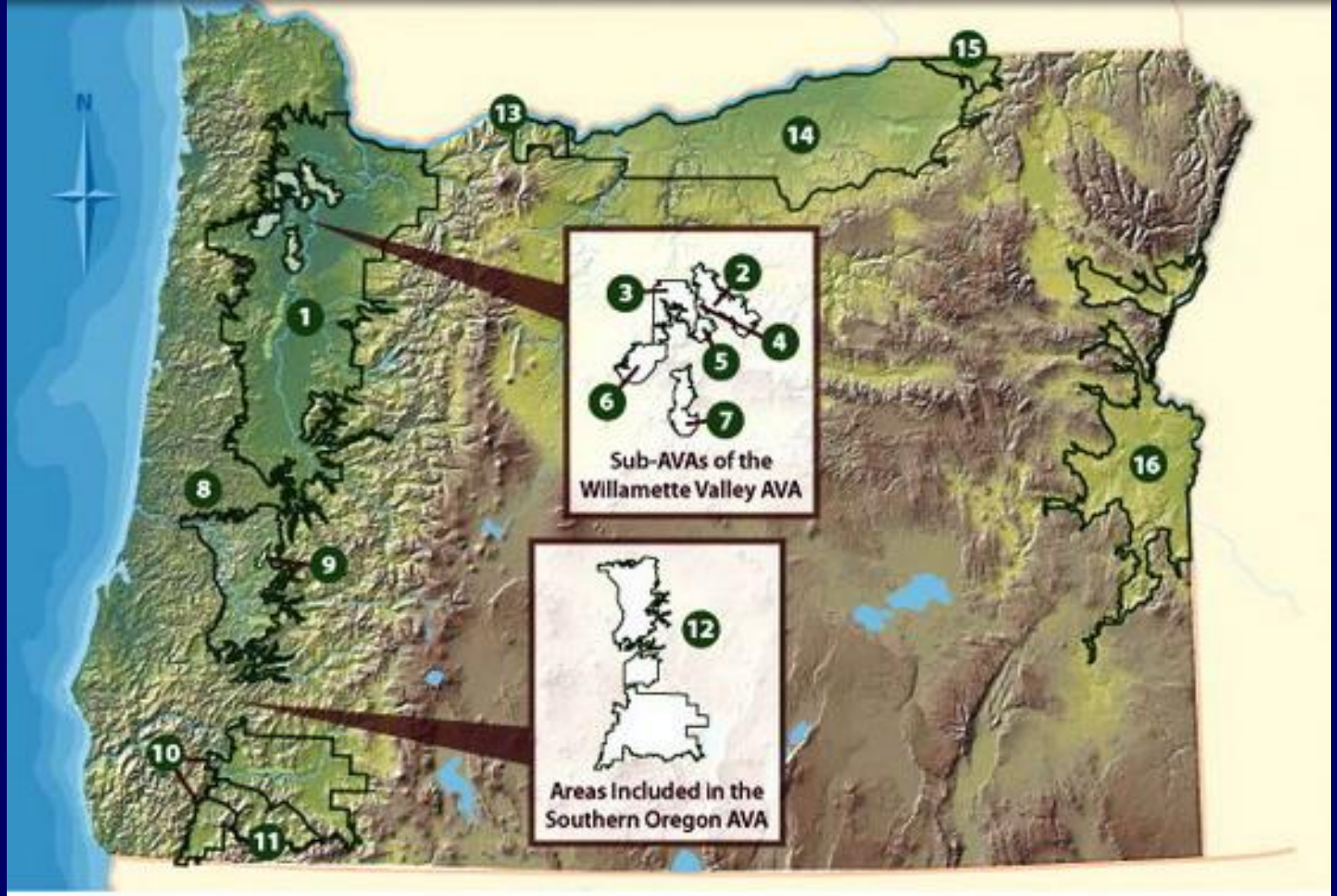
Christophe Baron – Cayuse Winery

The Rocks of M.F.



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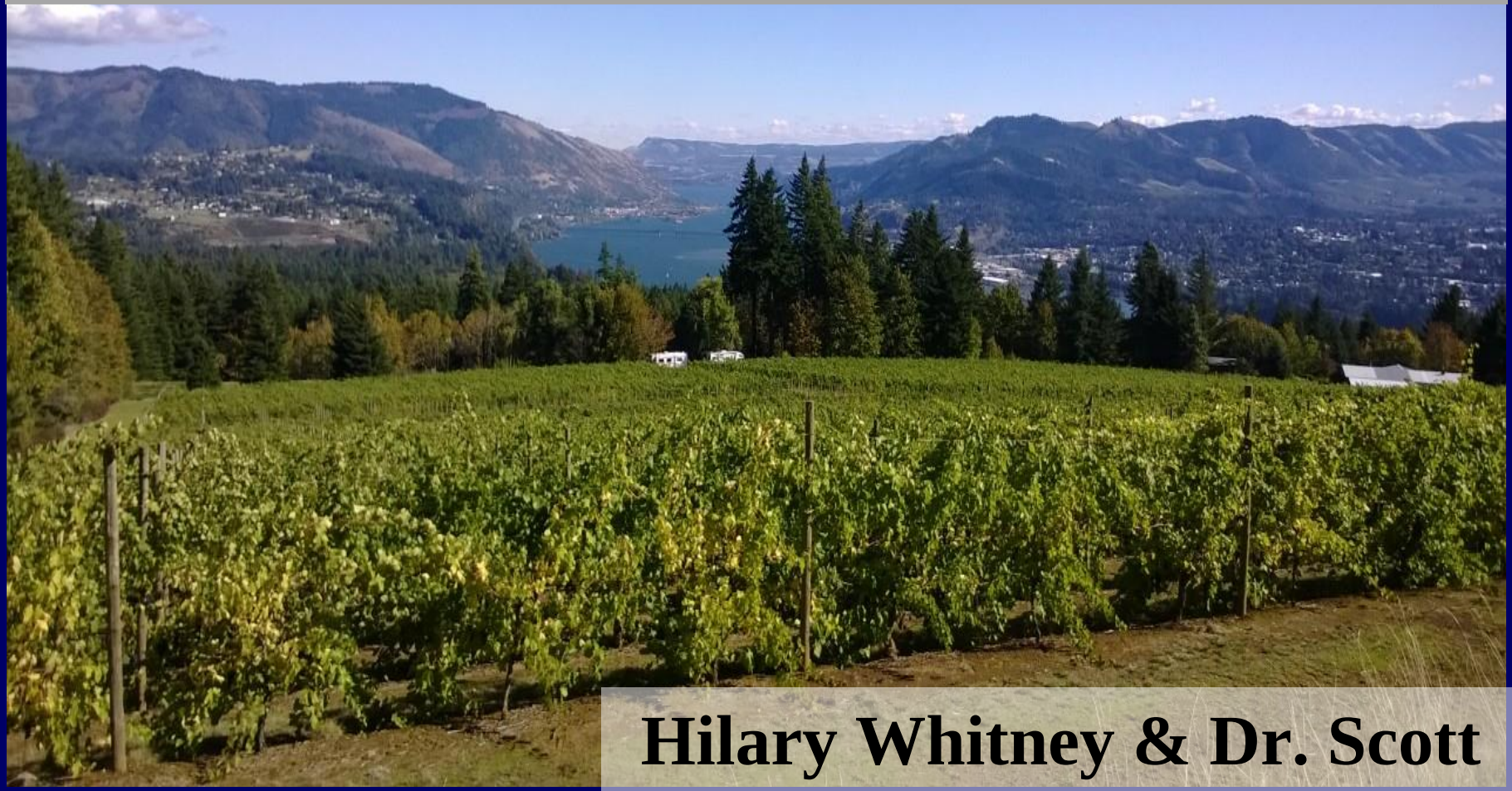
THE COLUMBIA GORGE WINE REGION



Hilary Whitney & Dr. Scott F. Burns

38 Wineries

83 vineyards

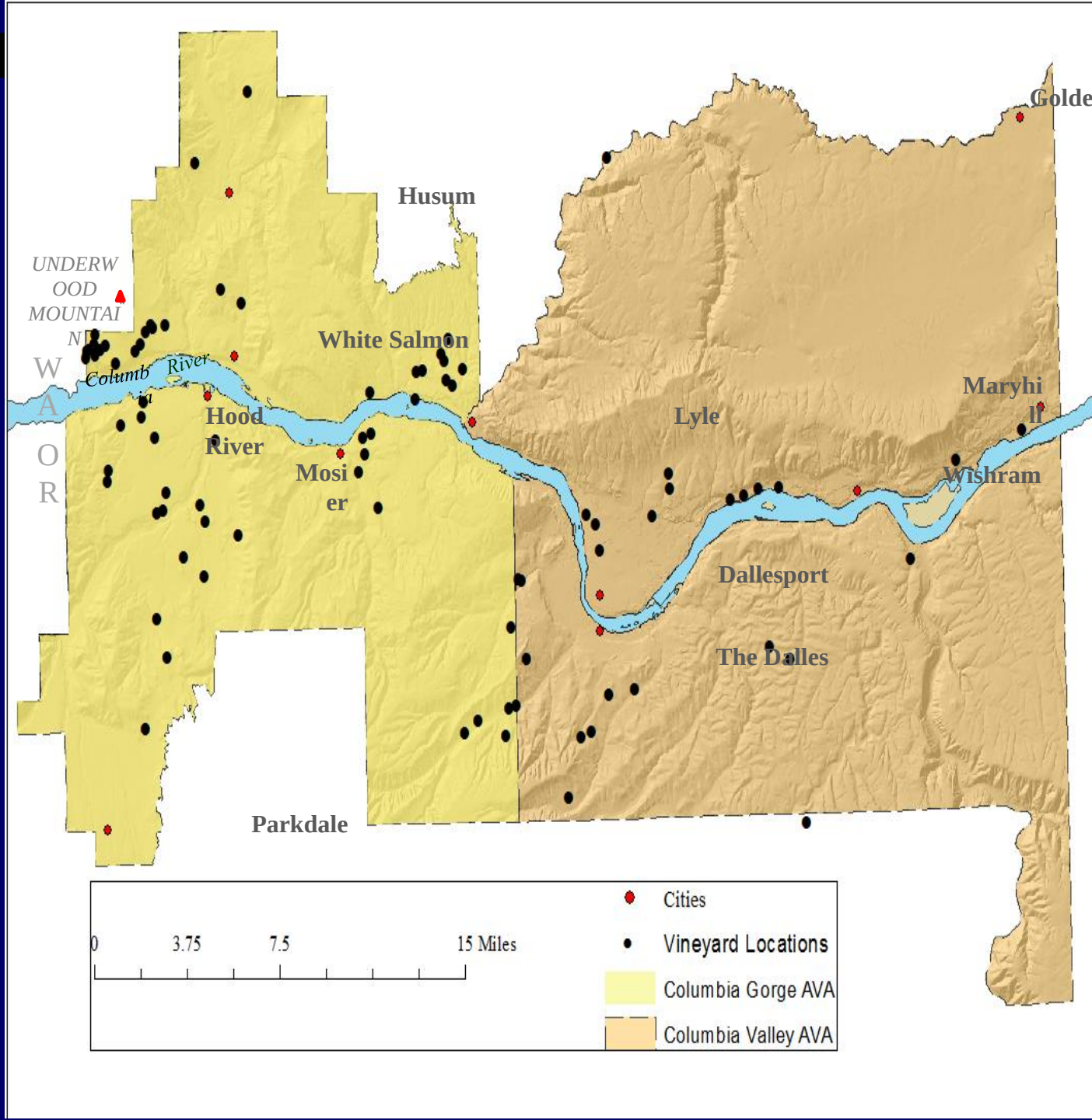
513 ha (1248 acres)

CG AVA: 56

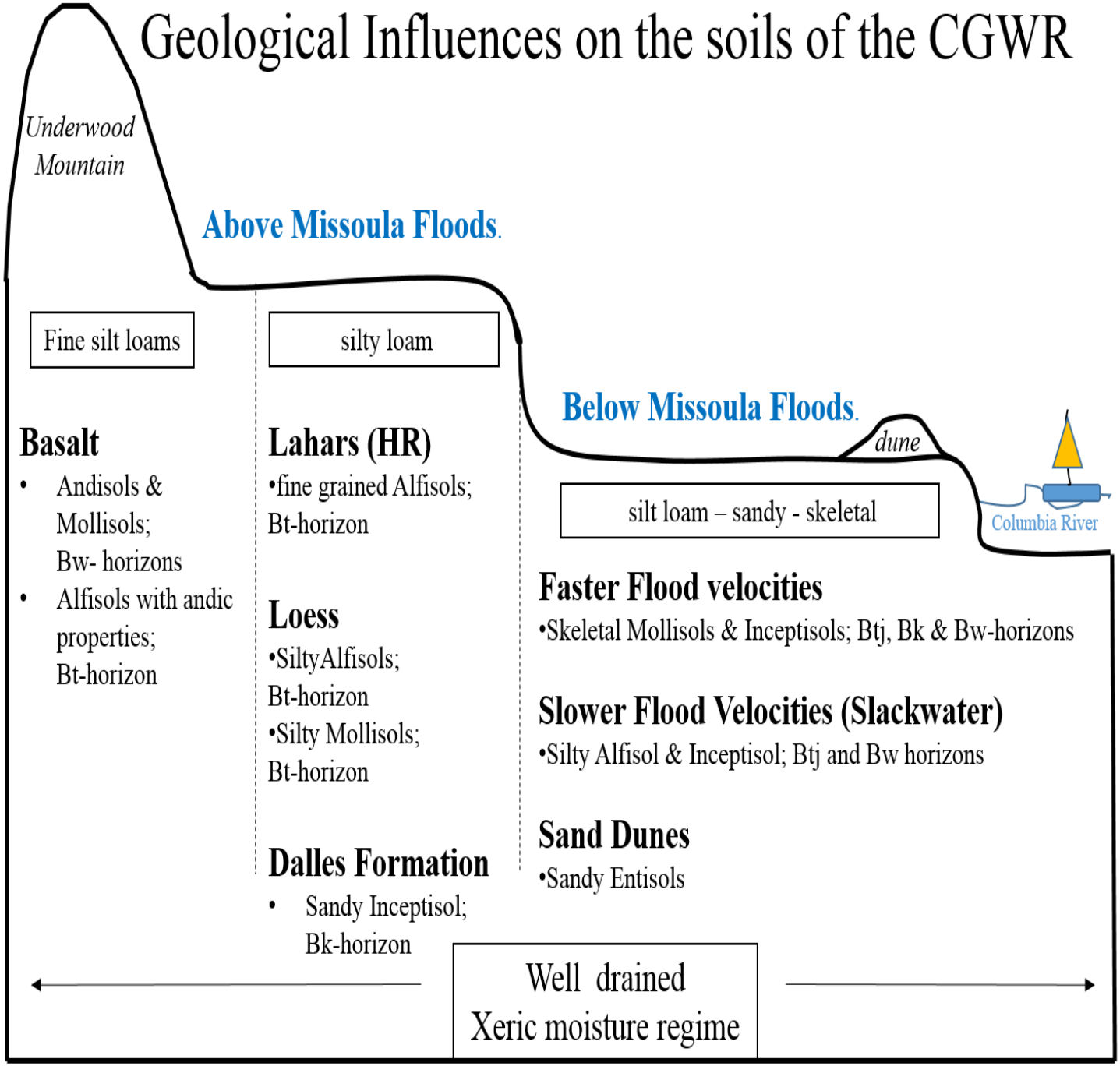
CV AVA: 24

Outside: 1.5

Size: 0.2 ha (0.5 acres) to 120 ha



Geological Influences on the soils of the CGWR



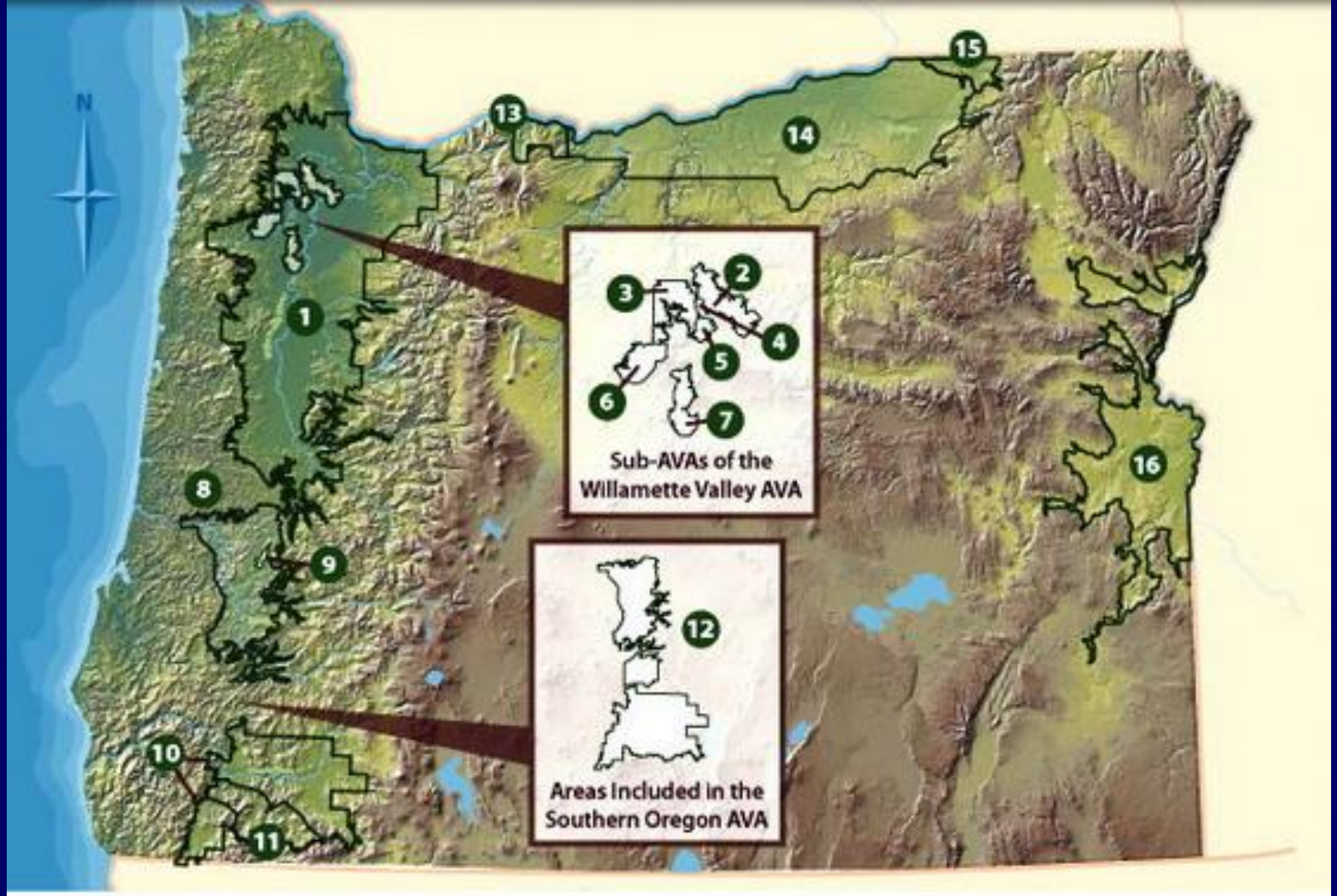
Geology of the Region

- Columbia River Basalt (mostly 15 Ma)
- Young Basalts (Underwood Mountain) – (.5 Ma)
- Lahars from Mt. Hood
- Missoula Flood Slackwater Deposits: Below:
  - Hood River (<280 meters – 840 feet)
  - Deschutes River mouth (<323 meters – 970 feet)
- Missoula Flood Deposits in Fast Water areas: skeletal (>35% fragments)
- Loess (windblown silt)
- Sand Dunes (Dallesport)


Oak Grove Series
Weathered Lahar


m
0·2
0·4
0·6
Loess Soil
Above Floods:
Gunn Series

Dallesport Series Below the Floods Skeletal



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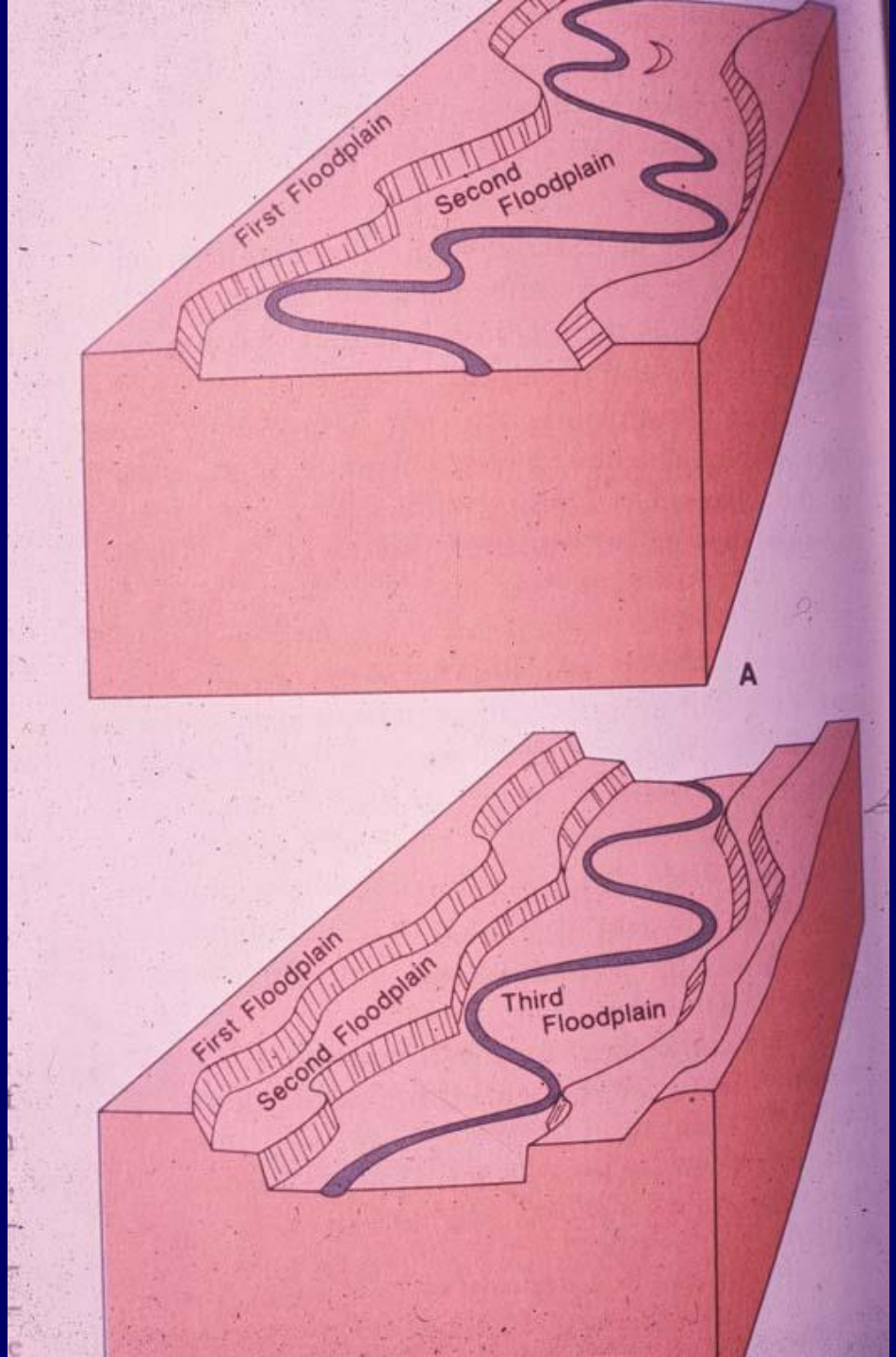
Alluvial gravels

Alluvial fan

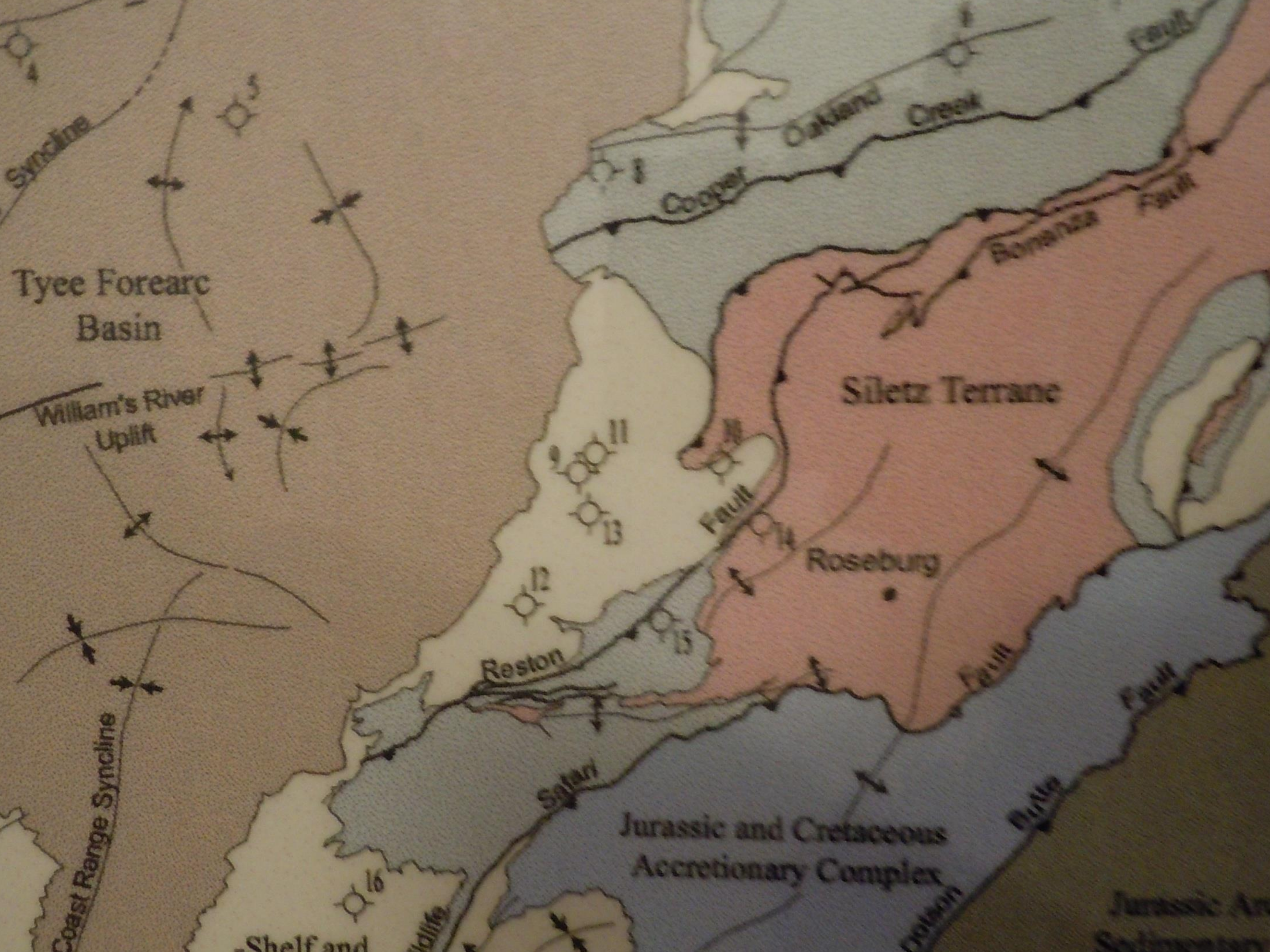
Val d’Arolla



Steam Terrace development

The Umpqua AVA

- Convergence of three mountain ranges: Coast Range, Klamath Mountains, and the Cascade Range
- Called the “Hundred Valleys of the Umpqua”
- Antecedent Stream: Umpqua (starts in Cascades and flows to Oregon Coast
- Climate – cool in north and warm in south


Syncline
Tyee Forearc
Basin
William's River
Uplift
Coast Range Syncline
Cooper
Oakland
Creek
Fault
Bonanza
Fault
Siletz Terrane
Fault
Roseburg
Reston
Safari
Jurassic and Cretaceous
Accretionary Complex
Fault
Butte
Fault
Shelf and

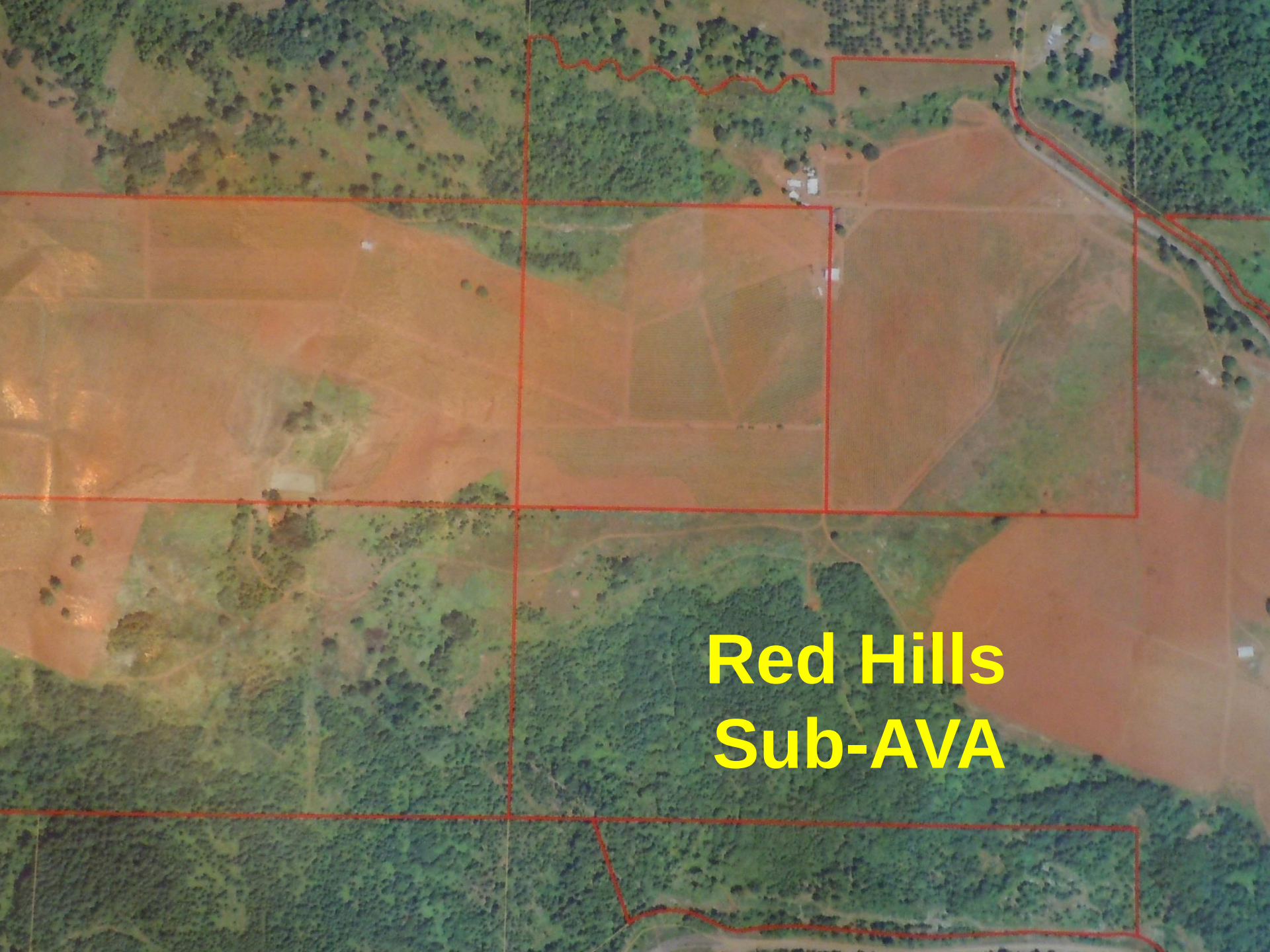
Tyee Fm – Coast Range (mainly Elkton Sub-AVA)

- 10 Wineries and Vineyards
- Geology: Tyee Fm (sandstones and shales) – uplifted sea floor of the southern Oregon Coast Range (Miocene mainly: 20-30 Ma)
- 121 acres

Anindor Winery

Red Hills Sub-AVA

- 1 vineyard and 530 acres
- Geology: Uplifted sea floor (Silezia Terrane) – 45 million year old basalt
- Soil: Jory Series


Red Hills
Sub-AVA

Umpqua Basin Turbidites

- 10 wineries and vineyards
- Tertiary uplifted sea floor of turbidites: mainly sandstones with some shales and conglomerates of Eocene Age (35-45 Ma)
- 213 acres

Reustle Prayer Rock Winery

Klamath Terrane: Geology/Soils

- Two Wineries
- Age: 225 Ma accreted terranes: partially metamophosed sandstones, shales, conglomerates, basalts, serpentine
- 54 acres


Abacela Winery

Umpqua Stream Terraces

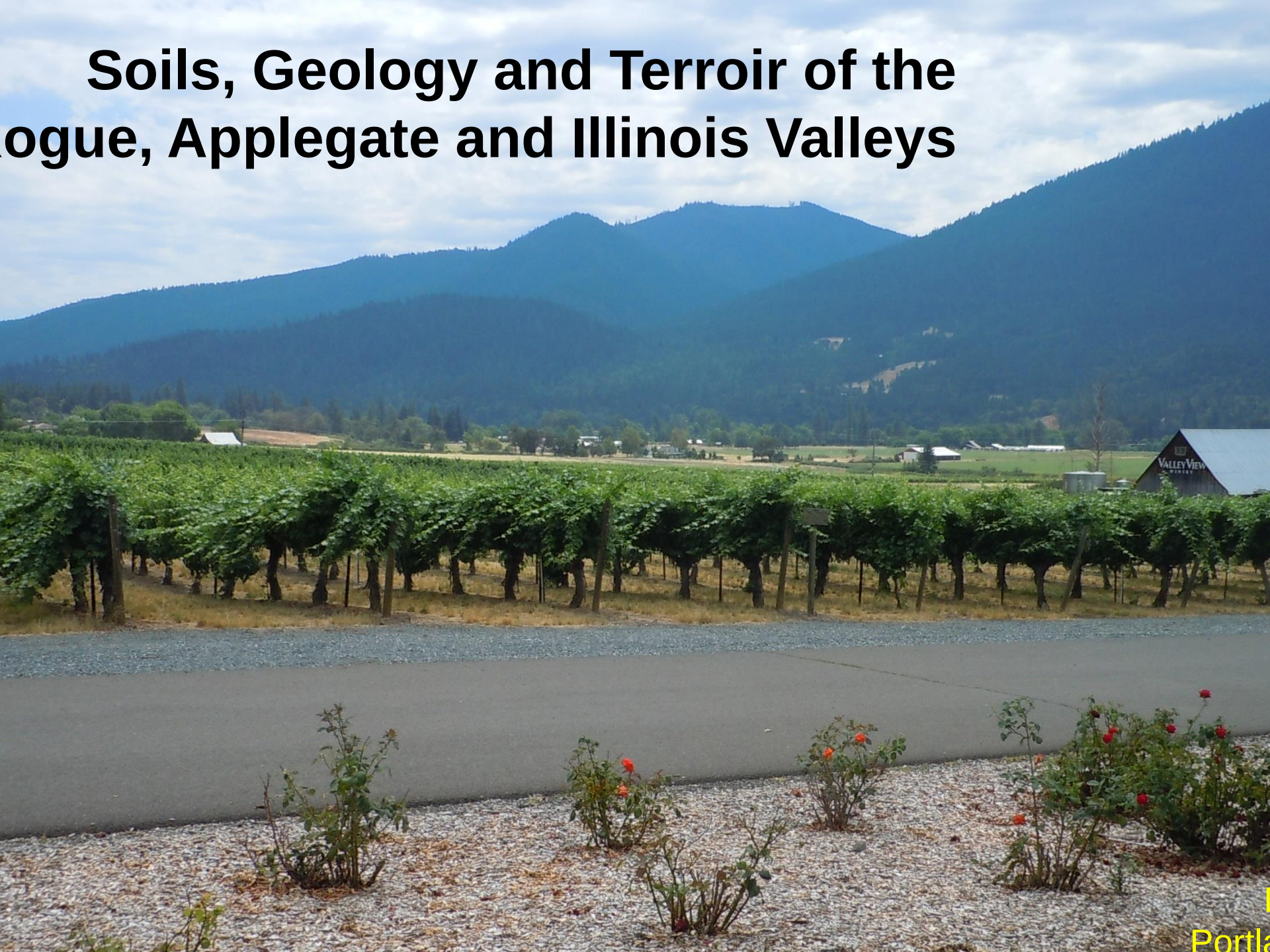
- 9 Wineries and Vineyards
- Geology: Quaternary Stream Terraces of the Umpqua River; Gravelly with thick silts on top
- 1272 Acres


Melrose Winery

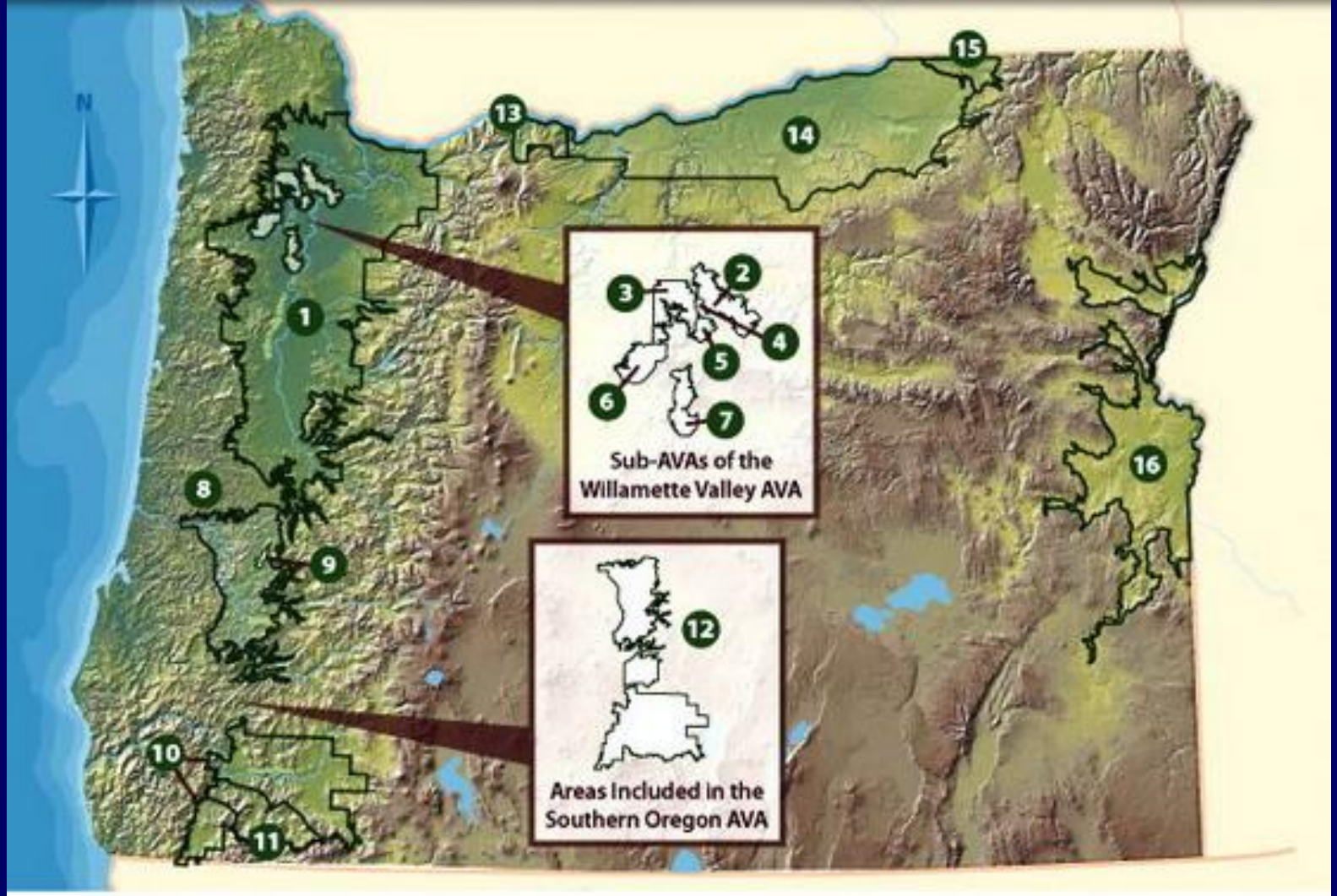
Conclusions

- 39 vineyards and 24 wineries: 2190 acres
- Five Major Terroir Regions:
  - 1) Elkton, Cool Climate, Coast Range Seds
  - 2) Red Hill, Cool Climate, Basalts, Jory Soil
  - 3) Umpqua Turbidites, Warm Climate
  - 4) Umpqua Terraces, Warm Climate
  - 5) Klamath Terrane, Warm Climate

Soils, Geology and Terroir of the ogue, Applegate and Illinois Valleys



Portla



— AMERICAN VITICULTURAL AREAS OF OREGON —

1 Willamette Valley	5 Dundee Hills	9 Red Hills Douglas County	13 Columbia Gorge
2 Chehalem Mountains	6 McMinnville	10 Rogue Valley	14 Columbia Valley
3 Yamhill-Carlton District	7 Eola-Amity Hills	11 Applegate Valley	15 Walla Walla Valley
4 Ribbon Ridge	8 Umpqua Valley	12 Southern Oregon	16 Snake River Valley

Rogue Valley: North Side

Rogue Valley North Side Summary

- 12 Wineries and 247 acres of grapes
- Geology: Mostly Tn (Tertiary weathered volcanics so lots of clay) (50 Ma age) and some fans
- Challenging soils – irrigation is an art! 90% of soils are Vertisols – clay rich soils


FLOW-GUARD
Filtration Products


Jaxon Vineyards: South-Facing


North Rogue Valley
Del Rio Vineyards

North Rogue Valley Summary

- Five wineries and 560 acres of grapes
- Geology: Mainly fans but some Tn (old volcanics of Cascades) – Agate Ridge and some of Folin Vineyards (50 Ma)

Cliff Creek Vineyards

Rogue Valley South Side Summary

- Geology: Mainly fans and stream terraces
- Some fans are fine-grained and some are coarse-grained (Pebblestone Cellars and Stone River Winery
- 20 Vineyards and 420 acres (11 are Quail Run Vineyards)


Dancin Vineyards

Applegate AVA

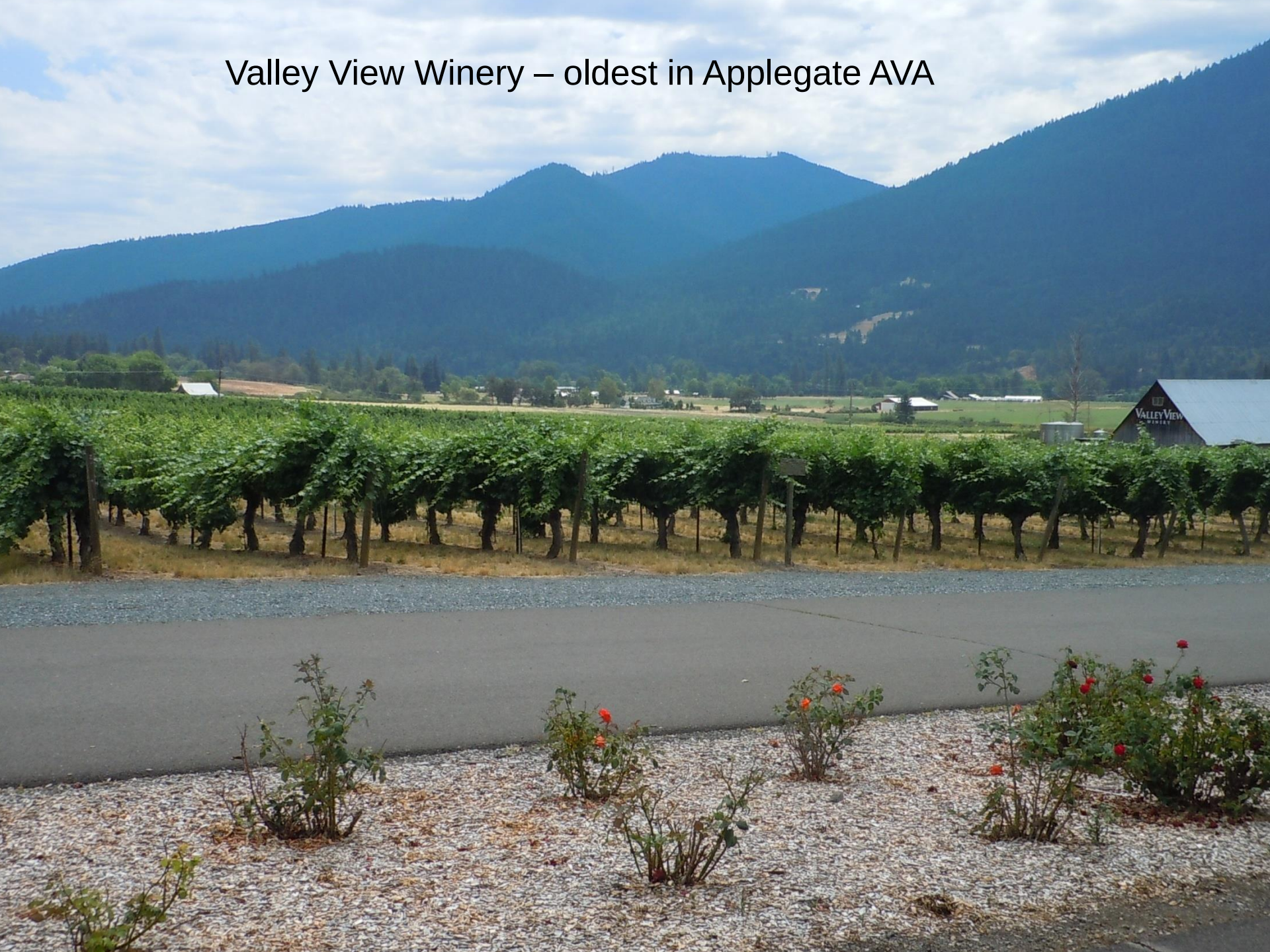
Serra

Applegate Valley Summary

- 27 Vineyards and Wineries and 455 acres in grapes

- Geology: All on Fans and stream terraces
- Most irrigate, but a few do not!

- Soils <10% Vertisols (clay rich); rest are well drained soils


Valley View Winery – oldest in Applegate AVA
VALLEY VIEW
WINERY

Illinois Valley: Foris Vineyards

Illinois Valley: Summary

- Geology: Mainly fans and stream terraces
- Five wineries and 450 acres of grapes
- All soils have some serpentine so Mg in soil is a big problem - add potassium
- Most are well-drained, but a few small places with clay-rich Vertisols

Conclusions

- Willamette Valley – 4 major geologic units; three that are the main ones
- Gorge – 7 major geologic units
- Rocks of Milton Freewater – Alluvium
- Umpqua – 5 geologic units
- Rogue – 3 geologic units
- Applegate and Illinois Valley – 2 units

Conclusions II

- How about ash – very little influence except at Sno Road Winery in Echo
- Landslides some places: extreme diversity: Rex Hill Jacob Hart, Anderson Family Estate, and Alexana Winery
- Tasting rooms – tell your geology story and your soil story!
- Celebrate Diversity – there are big differences in geology, therefore terroir!