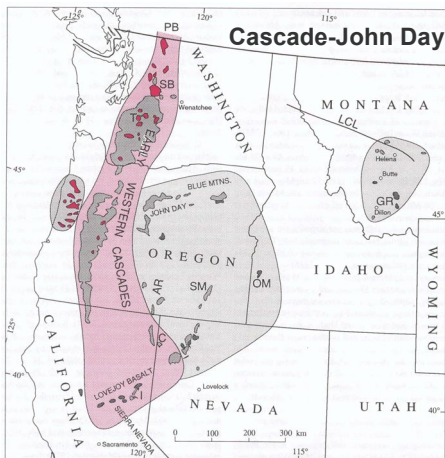


## Early Tertiary Magmatism Part II

Reference:

DNAG v. 3, Ch. 7, pp 294-314



## Magmatism in Western Cascades Arc

- Active from 38 to 17 Ma
- New volcanic activity west of Clarno Fm and south into Oregon
- Western Cascade volcanism was mostly andesitic
- Some rhyolitic ash-flow sheets
- Broad curving continuous belt of volcanoes

## Washington Magmatism

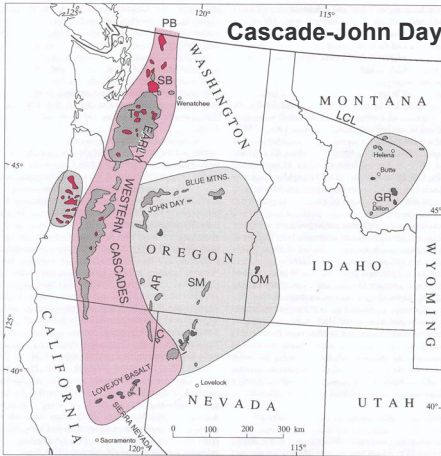
- Overlapped older Challis and Tuscarora belts
  - Numerous shallow batholiths
  - Snowqualmie Batholith
  - Tatoosh Pluton
- Represent subvolcanic magmatism
- Younger High Cascades follows the same trend

## Western Oregon

- Oligocene calc-alkaline volcanic rocks
  - Unconformable on Eocene rocks
- Andesite-dacite-rhyolite erupted from numerous centers
- Few shallow subvolcanic intrusives

## Southern Oregon

- No units younger than 17 Ma present
- Mafic alkalic rocks developed in front of the western Cascades
- Nepheline syenite, Camptonite, Ferrogabbro

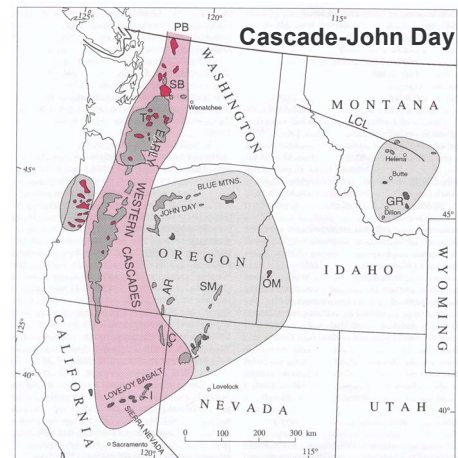


## Northern California

- Basaltic to rhyolitic volcanism
- Age range of 31 to 20 Ma
- Andesite mudflow breccias in Sierra foothills
  - Cedarville Volcanics
  - Extend into Nevada
  - Andesite breccias and rhyolite tuffs

## John Day Magmatic Region

- Age of 36 to 18 Ma
- Much downwind fall out from Western Cascades volcanism
- High-silica, alkali rhyolite is common
- Local alkali basalt to trachyte eruptions



## Southern Oregon

- Rhyolite to bimodal rhyolite-trachyandesite
- Summer lake, Goose Lake, Albert Rim
  - Rhyolites and tuffs
- Steens Mountain
  - Trachyandesite

## Other Locations

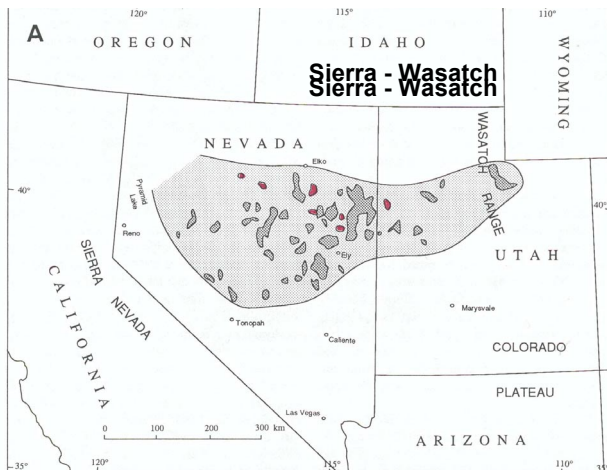
- Lovejoy basalt in California
  - Alkali basalts and trachyandesites
- Owyhee Mountains, Idaho
  - Fluid alkali basalt
- SW Montana
  - Bimodal rhyolites and basalts
  - Volcanism coincided with tectonic extension

## Sierra-Wasatch Magmatic Belt

- Constructional volcanic plain
  - Built before 43 Ma
  - Tuscarora belt of 43 to 37 Ma
- A new belt established in central Nevada
  - A series of south-stepping arcs

## Early Activity 37 To 34 Ma

- Continuous E-W belt
- Mainly rhyolitic volcanism
- General sequence of eruption
  - Andesites from central volcanoes
  - Voluminous silicic ash-flow s
  - Huge calderas

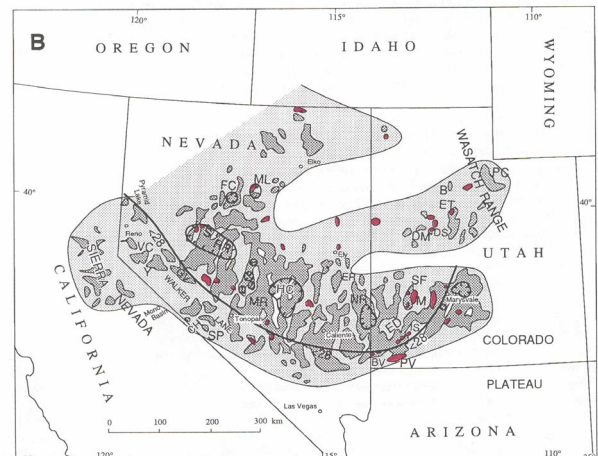


## Later Activity 34 To 21 Ma

- Belt is continuous in the west
- Splits into three prongs in the east
- A few stocks and other small intrusives
- Intermediate to silicic tuffs with associated calderas

## West and South Wasatch

- A band of volcanism started later (28 Ma)
- Continued into the following episode of volcanism
- Rocks are more mafic
  - K-rich mafic lavas and andesites

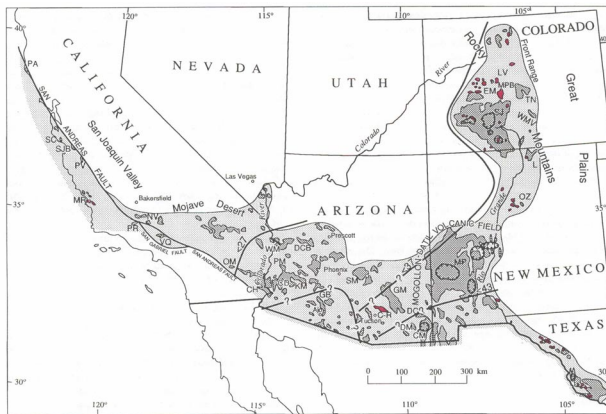


## Hydrothermal Ore Deposits

- Numerous deposits associated with this episode
- Chalcophile deposits
- Uranium mineralization

## Southern USA Cordillera

- Between 55 and 25 Ma (mid-Tertiary)
- Some areas with little or no volcanism
  - Southern Nevada
  - Eastern California
  - Western Arizona



## Sierra Madre of Mexico

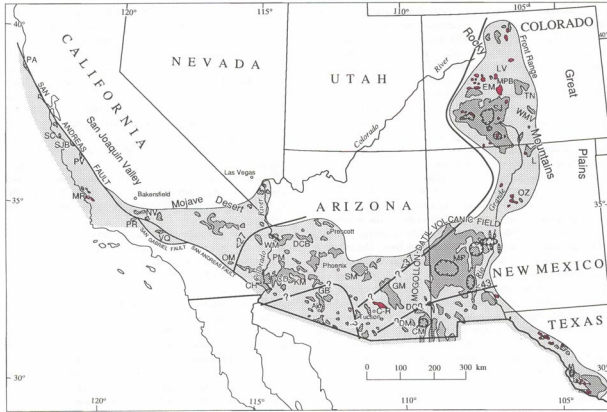
- Continuous volcanism from Laramide through mid-Tertiary times
- Mainly caldera forming ash-flow eruptions of silicic magmas
- Some andesites

## West Texas

- Began 49 Ma along Rio Grande
- Potassic andesite to rhyolite volcanism
- Mafic and alkalic volcanism farther east
- Major caldera forming eruptions 38 to 28 Ma

## SW New Mexico

- Calc-alkaline volcanism began 43 Ma
- Mogollon-Datil Volcanic Field
- Initial andesitic magmas followed by silicic caldera-forming eruptions
- Basalt was scarce
- Mogollon Plateau (34 to 28 Ma)
  - Upper crustal batholith emplaced
  - Associated with tuffs and calderas

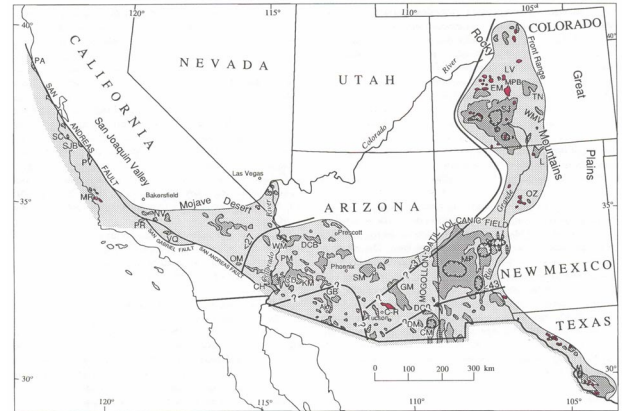


## Southern Rockies

- Potassic calc-alkaline volcanism began with 41 Ma andesites
- 37 to 27 Ma stratovolcanoes in N. New Mexico
- Evolved to 27 Ma calderas associate with crustal extension
- Small intrusions with Mo mineralization 23 to 21 Ma

## San Juan Mountains

- 31 to 27 Ma
- Large ash-flow sheets overlying supracrustal batholith
- Huge calderas formed
- Rhyodacite to rhyolite composition
- Epizonal intrusions in Colorado Mineral belt have Mo mineralization

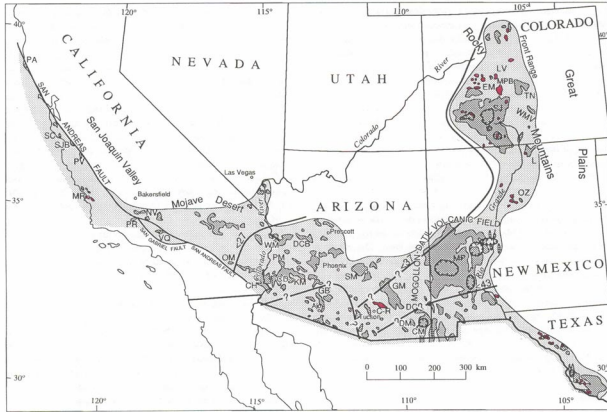


## Mogollon Highland of Arizona

- Earliest activity was 37 to 25 Ma
- Mainly Potassic andesites
- May represent metasomatism associated with detachment faulting

## Arizona Belt of Rhyolite Tuffs

- Chiricahua Mountains
  - Andesite lavas followed by rhyolitic tuffs
  - 32 to 23 Ma
- Galiuro Mountains
  - Age of 29 to 23 Ma
  - Andesite lava overlain by rhyolitic tuff
- Superstition Mountains
  - 29 to 25 Ma basalt to andesite
  - 24-20 Ma dacite to rhyolite tuffs

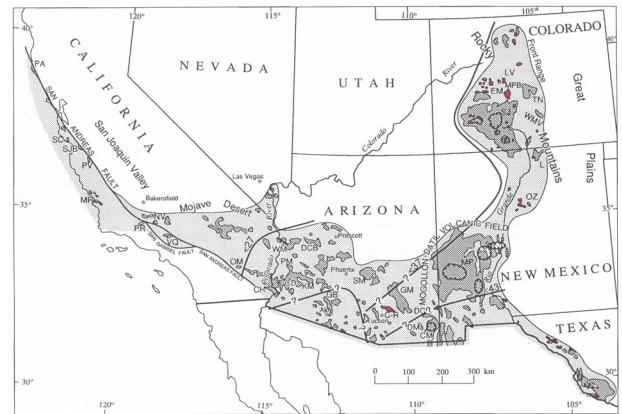


## Mineral Deposits

- Less differentiated centers host chalcophile base-metal deposits
- Younger rhyolites host lithophile mineral deposits (Li, Be, Sn)
- Major Mo porphyries in southern Rockies 30-23 Ma

## Sonoran-Mojave-Coast Range

- Magmatism began 35 to 27 Ma
- Magmatism became more silicic with time
- Composition is potassic, calc-alkaline
- Major silicic volcanism about 25 Ma
- Volcanic fields offset by the San Andreas Fault
  - Displacements as much as 300 km



## Southern Foreland Magmatism

- Alkalic magmatism
- Younger analogue of Eocene alkalic magmatism on the northern Great Plains

## Trans-Pecos Province 49 to 32 Ma

Stocks, sills, laccoliths, and shields

- Two series
  - Hawaii, mugearite, nepheline trachyte, phonolite
  - Trachy andesite, quartz trachyte, peralkaline rhyolite
- Compositions resemble rift environments

## Trans-Pecos Southern Great Plains



## Localities of Alkalic Rocks

- Ruidoso-Carrizozo, central New Mexico
  - 35 to 25 Ma syenite stock
  - Mo deposits
- Laughlin Peak
  - 37 to 26 Ma
  - Mugearite, trachyte, phonolite
  - Th, REE veins

## Southern Colorado

- Spanish Peaks,
  - 26 to 20 Ma
  - Stocks and dikes
  - Trachy basalt to trachy andesite
- Cripple Creek
  - 34 Ma trachyte-phonolite volcano
  - Gold deposits

## Colorado Plateau

- Navajo Volcanic Field
  - 30 Ma diatremes and pipes
  - Biotite and leucite-bearing rocks
  - Trachy basalts and minettes
- Abajo Mountains
  - 28 Ma stocks
  - Hornblende diorite porphyry

## Trans-Pecos Southern Great Plains



## Utah

- La Sal Mountains
  - 24 Ma hornblende diorite
  - Minor monzonite, syenite, and sodalite syenite
- Henry Mountains
  - 48 to 44 Ma hornblende diorite porphyry

**Trans-Pecos  
Southern Great  
Plains**

