

Advanced Structural Geology, Fall 2022

# California and Arizona Geologic maps

Ramón Arrowsmith

[ramon.arrowsmith@asu.edu](mailto:ramon.arrowsmith@asu.edu)

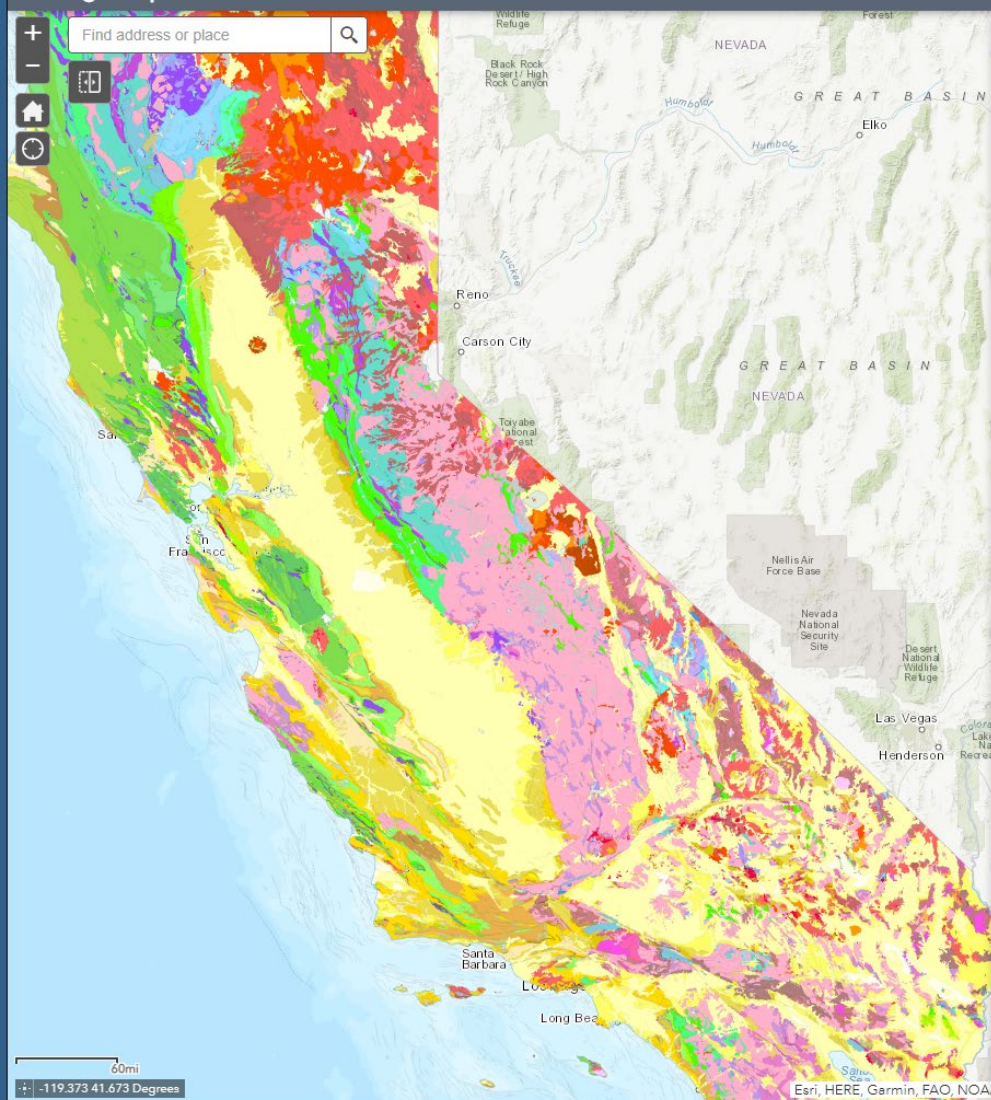


<https://www.usgs.gov/media/images/geologic-map-north-america>



## Geologic Map of California

California Geological Survey



## Explanation

California Geological Survey, Geologic Data Map No. 2

Compilation and Interpretation by: Charles W. Jennings (1977)

Updated version by: Carlos Gutierrez, William Bryant, George Saucedo, and Chris Wills

Graphics by: Milind Patel, Ellen Sander, Jim Thompson, Barbara Wanish and Milton Fonseca

## DESCRIPTION OF MAP UNITS

## QUATERNARY DEPOSITS

- Qs** Extensive marine and nonmarine sand deposits, generally near the coast or desert playas
- Q** Alluvium, lake, playa, and terrace deposits; unconsolidated and semi-consolidated
- Qla** Selected large landslides
- Qg** Glacial till and moraines. Found at high elevations mostly in the Sierra Nevada and Klamath Mountains
- Qoa** Older alluvium, lake, playa, and terrace deposits
- Qpc** Pleistocene and/or Pliocene sandstone, shale, and gravels deposits; mostly loosely consolidated

## QUATERNARY VOLCANIC ROCKS

- Qrv** Recent (Holocene) volcanic flow rocks; minor pyroclastic deposits
- Qrvf** Recent (Holocene) pyroclastic and volcanic mudflow deposits
- Qv** Quaternary volcanic flow rocks; minor pyroclastic deposits
- Qvf** Quaternary pyroclastic and volcanic mudflow deposits

## TERTIARY SEDIMENTARY ROCKS

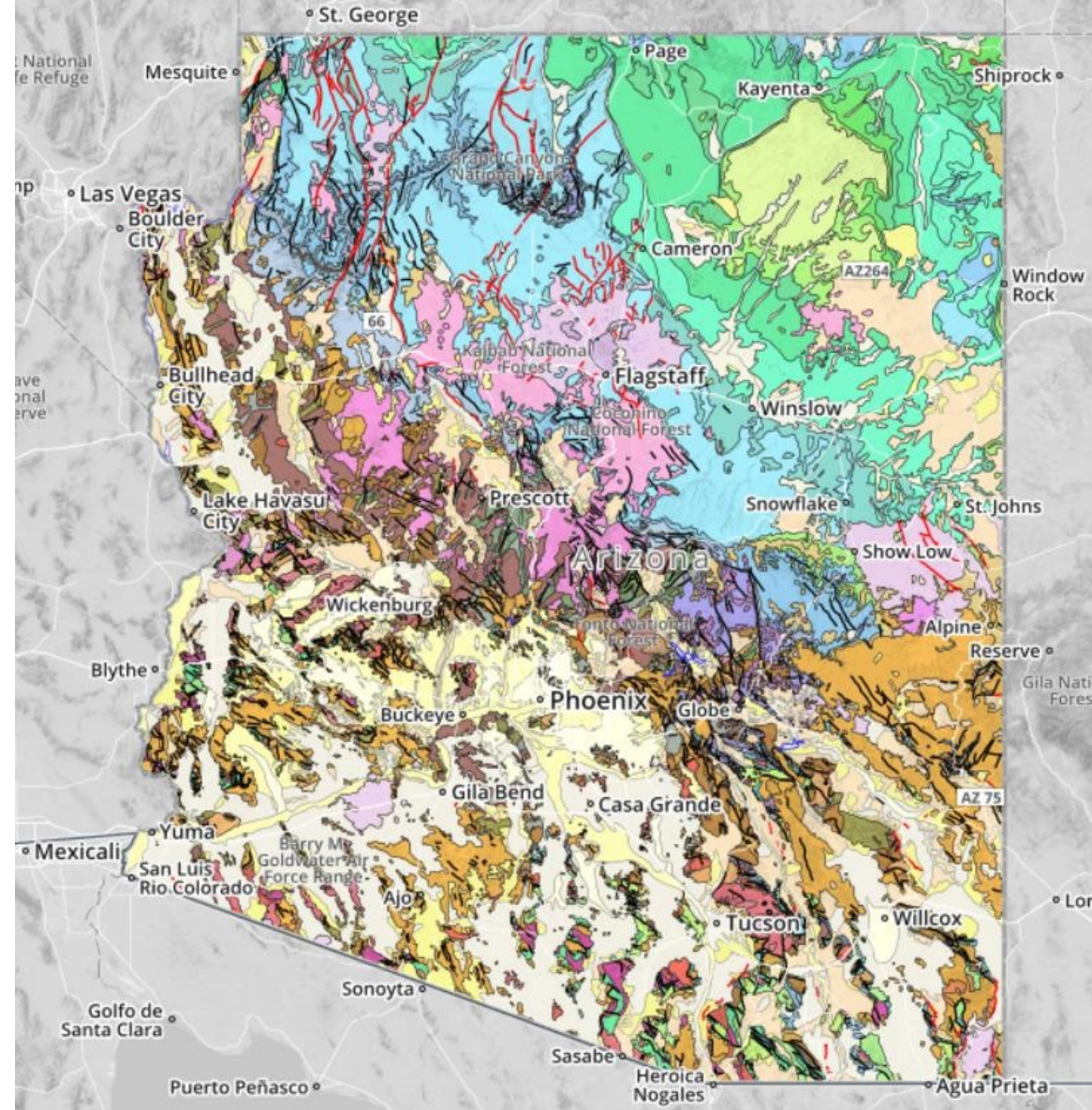
- Tc** Undivided Tertiary nonmarine sandstone, shale, conglomerate, breccia, and ancient lake deposits
- P** Pliocene marine sandstone, siltstone, shale, and conglomerate; mostly moderately consolidated
- M** Miocene marine sandstone, shale, siltstone, conglomerate, and breccia; moderately to well consolidated
- Mc** Miocene nonmarine sandstone, shale, conglomerate, and fanglomerate; moderately to well consolidated
- Qs** Oligocene marine sandstone, shale, and conglomerate; mostly well consolidated
- Qz** Oligocene nonmarine sandstone, shale, and conglomerate; mostly well consolidated
- E** Eocene marine shale, sandstone, conglomerate, and minor limestone; mostly well consolidated
- Ec** Eocene nonmarine sandstone, shale, and conglomerate; moderately to well consolidated
- Ep** Paleocene marine sandstone, shale, and conglomerate; mostly well consolidated

## TERTIARY VOLCANIC ROCKS

- Tv** Tertiary volcanic flow rocks; minor pyroclastic deposits
- Tvf** Tertiary pyroclastic and volcanic mudflow deposits.
- Ti** Tertiary intrusive rocks; mostly shallow (hypabyssal) plugs and dikes

## TERTIARY PLUTONIC ROCKS

- g<sup>tr</sup>** Cenozoic (Tertiary) granitic rocks - quartz monzonite, quartz latite, and minor monzonite, granodiorite, and granite; found in the Kingston, Panamint, Amargosa, and Greenwater Ranges in southeastern California



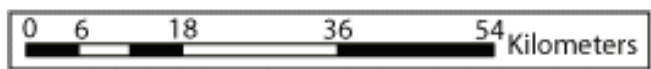
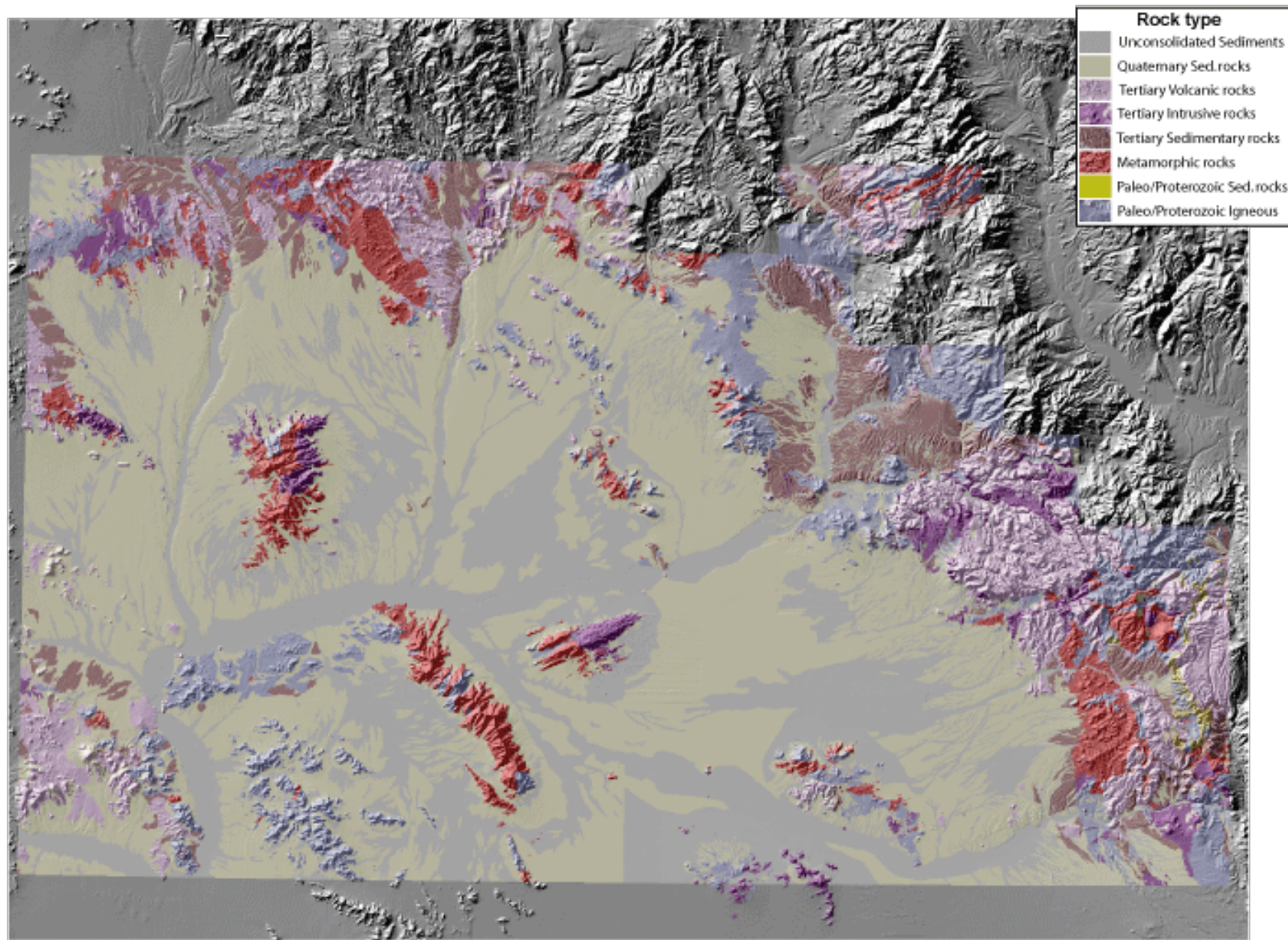
<https://maps.conservation.ca.gov/cgs/gmc/>

<https://azgs.arizona.edu/photo/geologic-map-arizona>

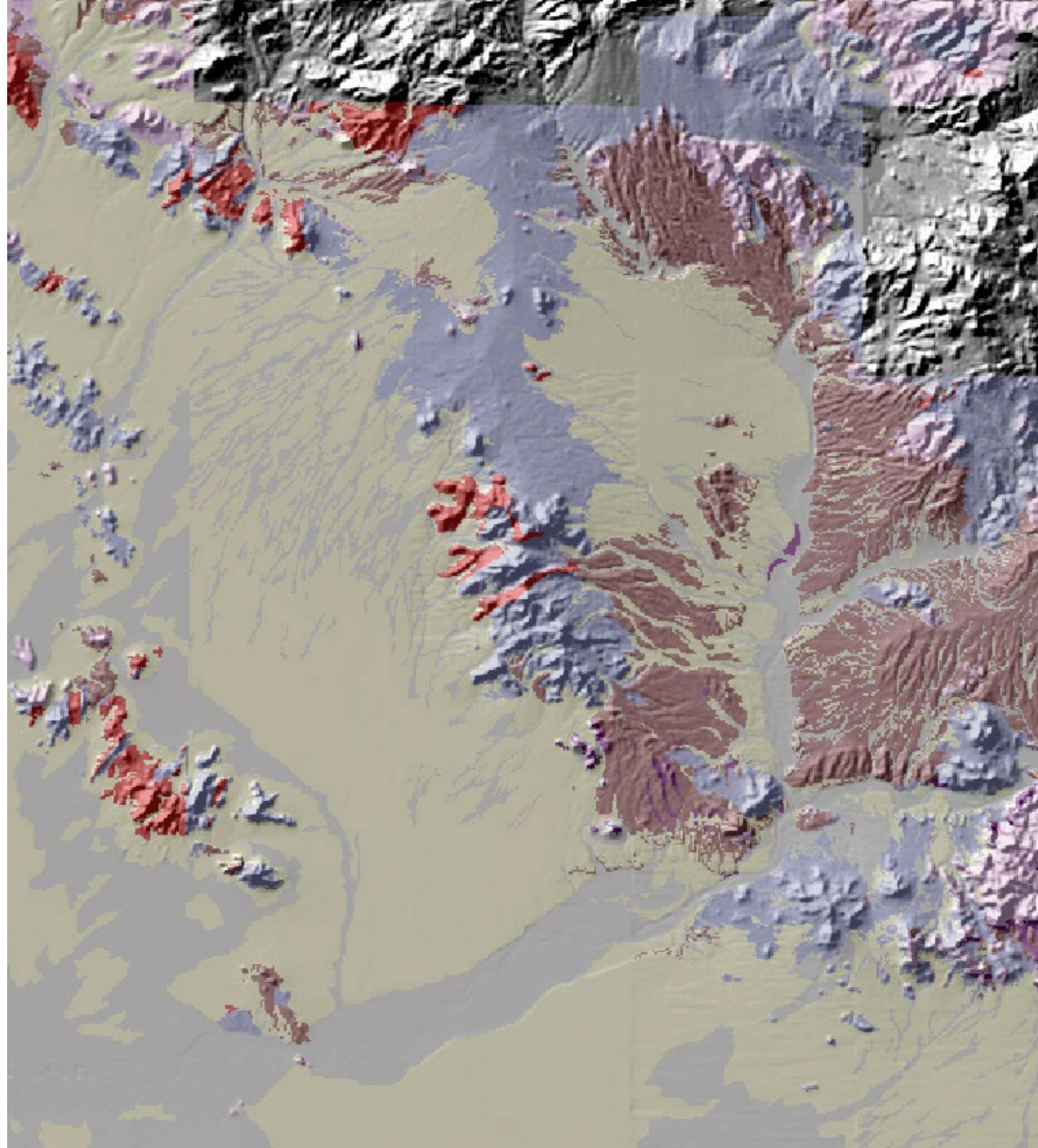
# Geology scavenger hunt—Arizona

Label on [http://repository.azgs.az.gov/sites/default/files/dlio/files/nid1705/geologic\\_map\\_of\\_az\\_-\\_m35.pdf](http://repository.azgs.az.gov/sites/default/files/dlio/files/nid1705/geologic_map_of_az_-_m35.pdf)









- Where and how old is oldest AZ rock?
- What and how old are blue and green units in NE Arizona?
- Within 100 km of Phoenix what are the main geologic units?
- Look for Tv/Tb, Tvy, QTv, Qtb. Is there a general trend in their spatial distribution?
- What is the Tso unit and where is it preserved?
- Where are the youngest faults in Arizona?

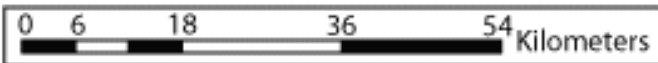
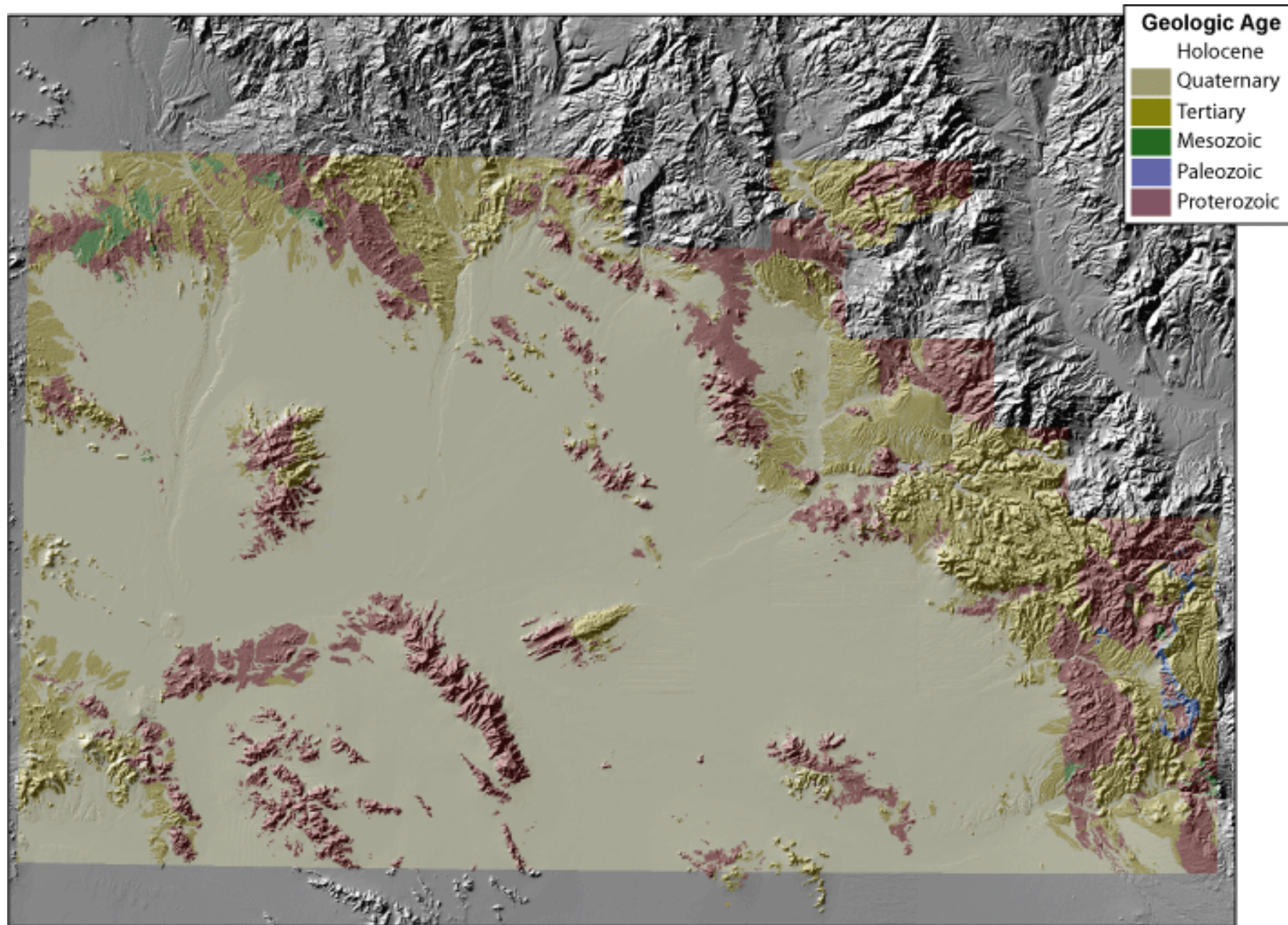


Phoenix area lithology and shaded relief  
J Ramón Arrowsmith and A MacLeod, ASU Geological Sci.

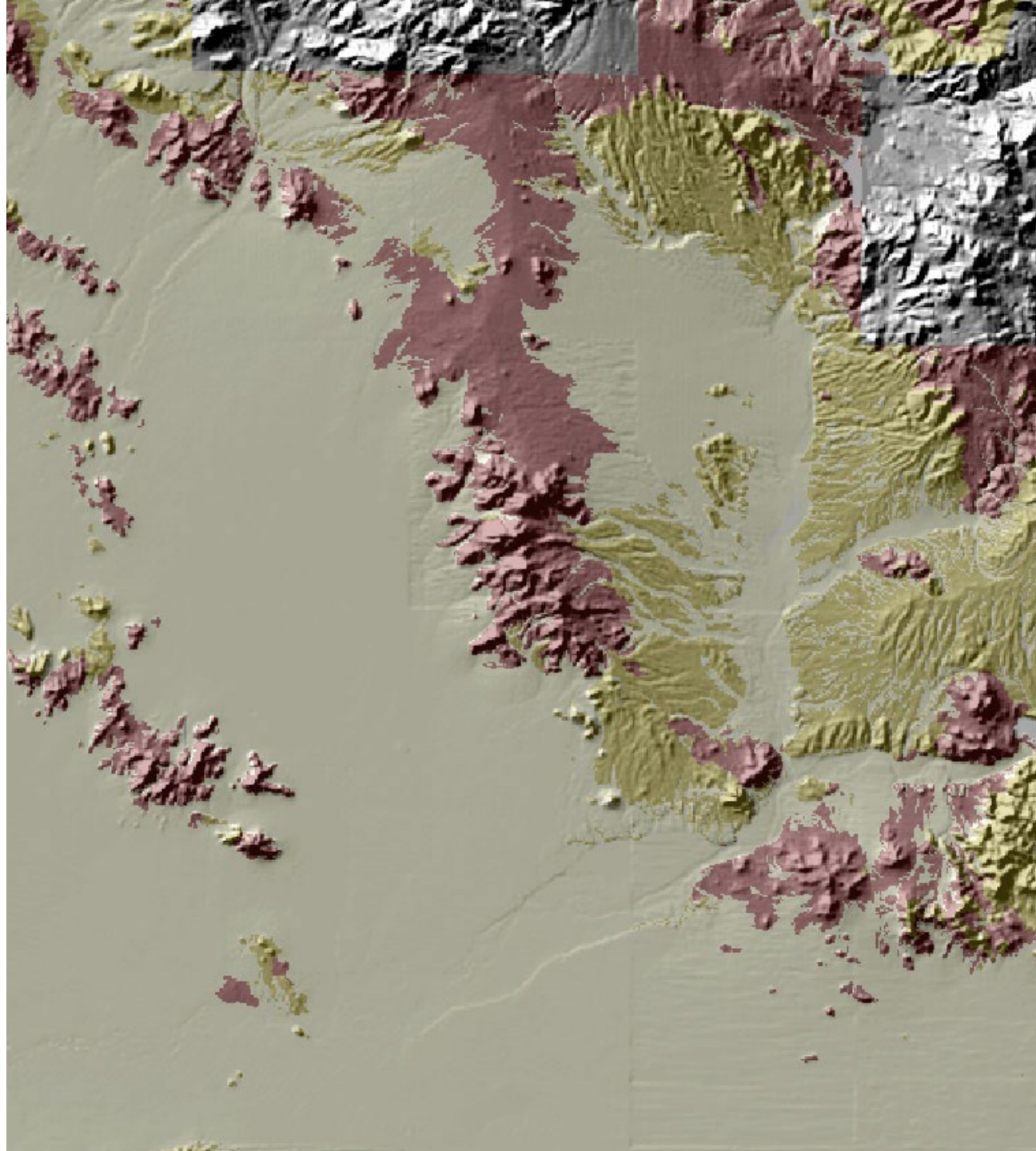


## Rock type

|   |                              |
|---|------------------------------|
|   | Unconsolidated Sediments     |
|  | Quaternary Sed. rocks        |
|  | Tertiary Volcanic rocks      |
|  | Tertiary Intrusive rocks     |
|  | Tertiary Sedimentary rocks   |
|  | Metamorphic rocks            |
|  | Paleo/Proterozoic Sed. rocks |
|  | Paleo/Proterozoic Igneous    |



Phoenix area geology by age and shaded relief  
J Ramon Arrowsmith and A MacLeod, ASU Geological Sci.



## Geologic Age

Holocene

 Quaternary

 Tertiary

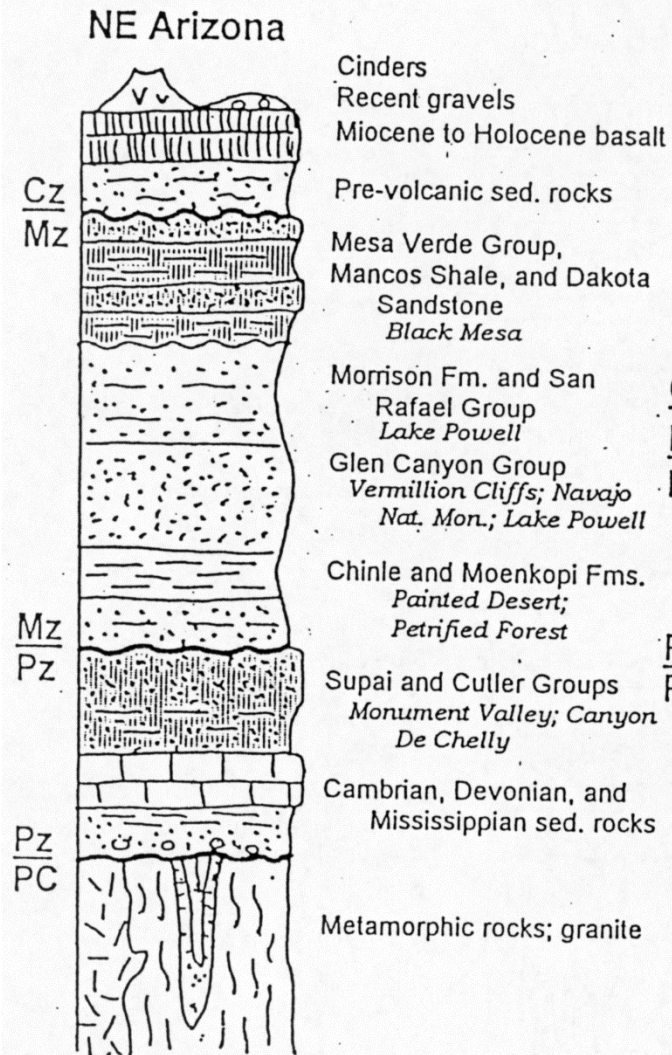
 Mesozoic

 Paleozoic

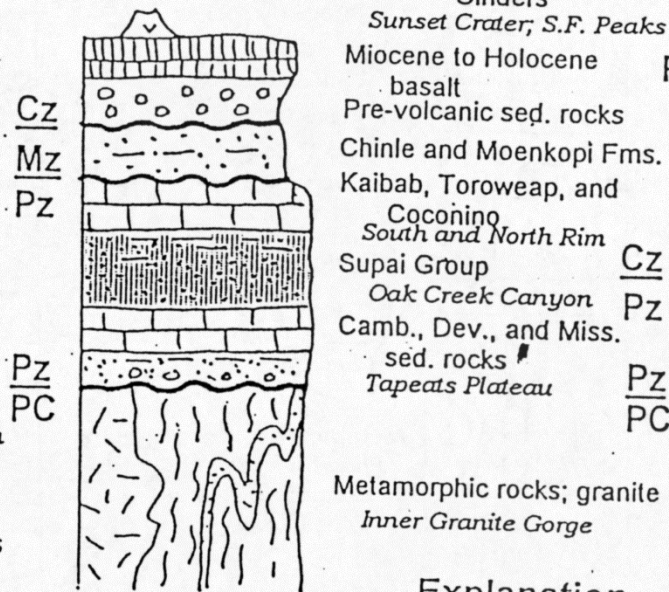
 Proterozoic



## Colorado Plateau

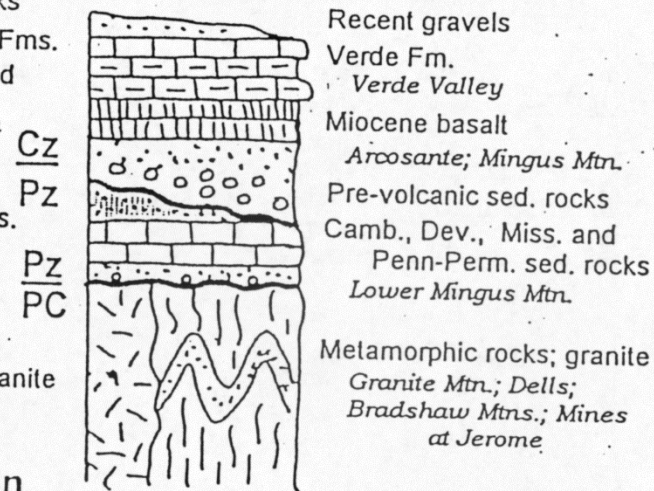


## Flagstaff - Grand Canyon - Sedona



## Transition Zone (western)

### Prescott - Jerome



### Explanation

Rock types are shown in normal text, and well-known places where the rock type is present are shown in italics beneath the rock type. A "/" between two rock types (for example tan ss/ red shale) indicates that the first rock type overlies the second one.

Cz  
Mz Major unconformity, where rocks of the upper age were deposited on top of an erosion surface cut across rocks of the lower age; unconformities within an Era (for example between two units of Mz age) are not labeled.

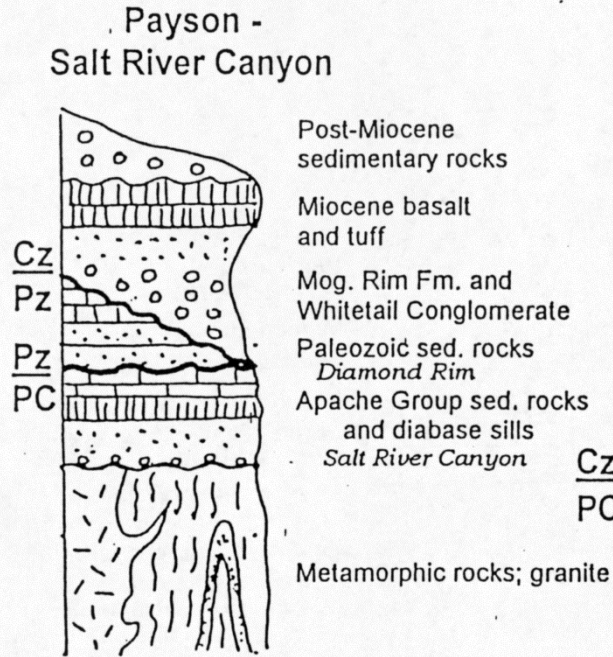
Cz = Cenozoic (0 to 66 m.y. ago);

Mz = Mesozoic (66 to 245 m.y. ago);

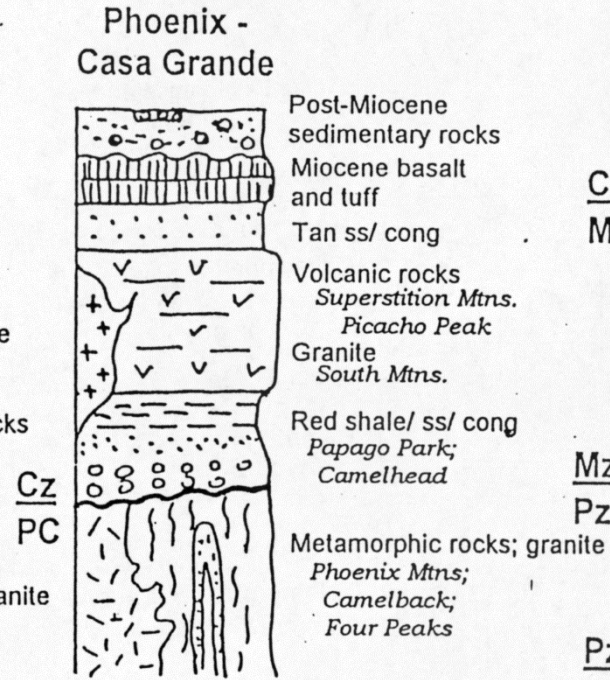
Pz = Paleozoic (245 to 560 m.y. ago);

PC = Precambrian (mostly 1.0 to 1.8 billion years ago; Precambrian rocks older or younger than this age range are not common in Arizona)

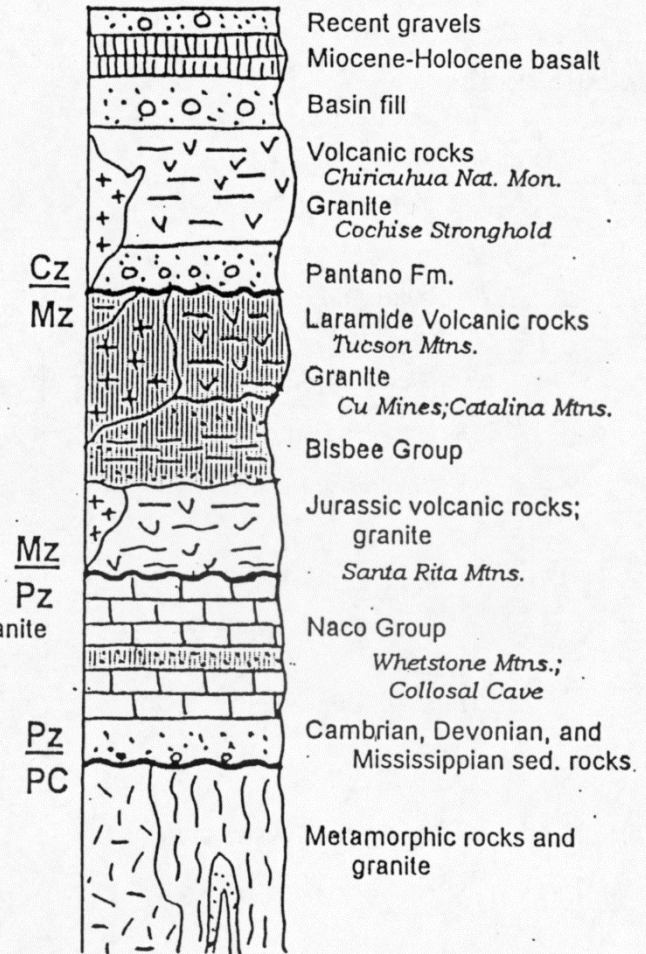
## Transition Zone (eastern)



## Basin and Range Province



## SE Arizona



Schematic stratigraphic sections for various parts of Arizona.

# Geology scavenger hunt—California

Label on <https://www.earthsciweek.org/sites/default/files/GMD/SimplifiedGeologicMapofCalifornia.pdf>

- Where and how old are the oldest rocks in California?
- Where is the main Mesozoic Arc?
- Where is the main Mesozoic accreted units?
- What are the (dark) purple units?
- What are the main rock units in the Klamath Mountains?
- Label and roughly how long is the bedrock offset on the San Andreas Fault?
- What is the distribution of T<sub>v</sub> in the Coast Ranges?