

Some Seismic Hazard Issues in Arizona

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Consider some key issues for seismic hazard assessments

➤ Historical seismicity

- What historical events included in probabilistic assessments?
- Detection thresholds, incipient broad-band seismic network

➤ Quaternary faulting updates

- Revised Q fault compilation; even more low-slip-rate faults
- Any impact on probabilistic assessments?
- New info on particular faults

➤ Geodetic strain rates

- Surprisingly high in some areas
- Substantial implications for seismic hazard?



Historical Seismicity in Arizona

~ 1850 to 1900

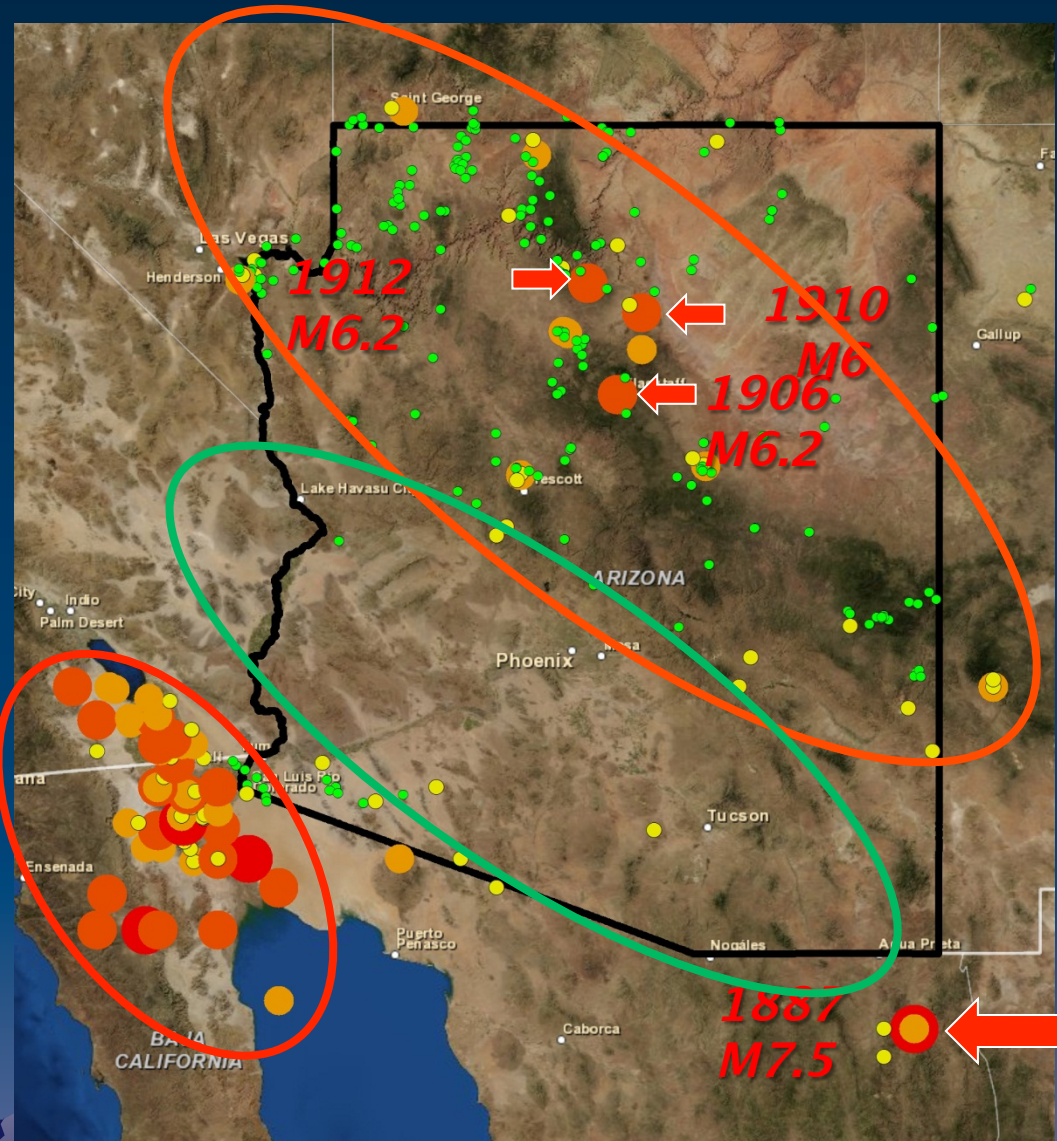
- lots of action in N Mexico, S California
- *a big earthquake in the southern Basin and Range*

1900 to present

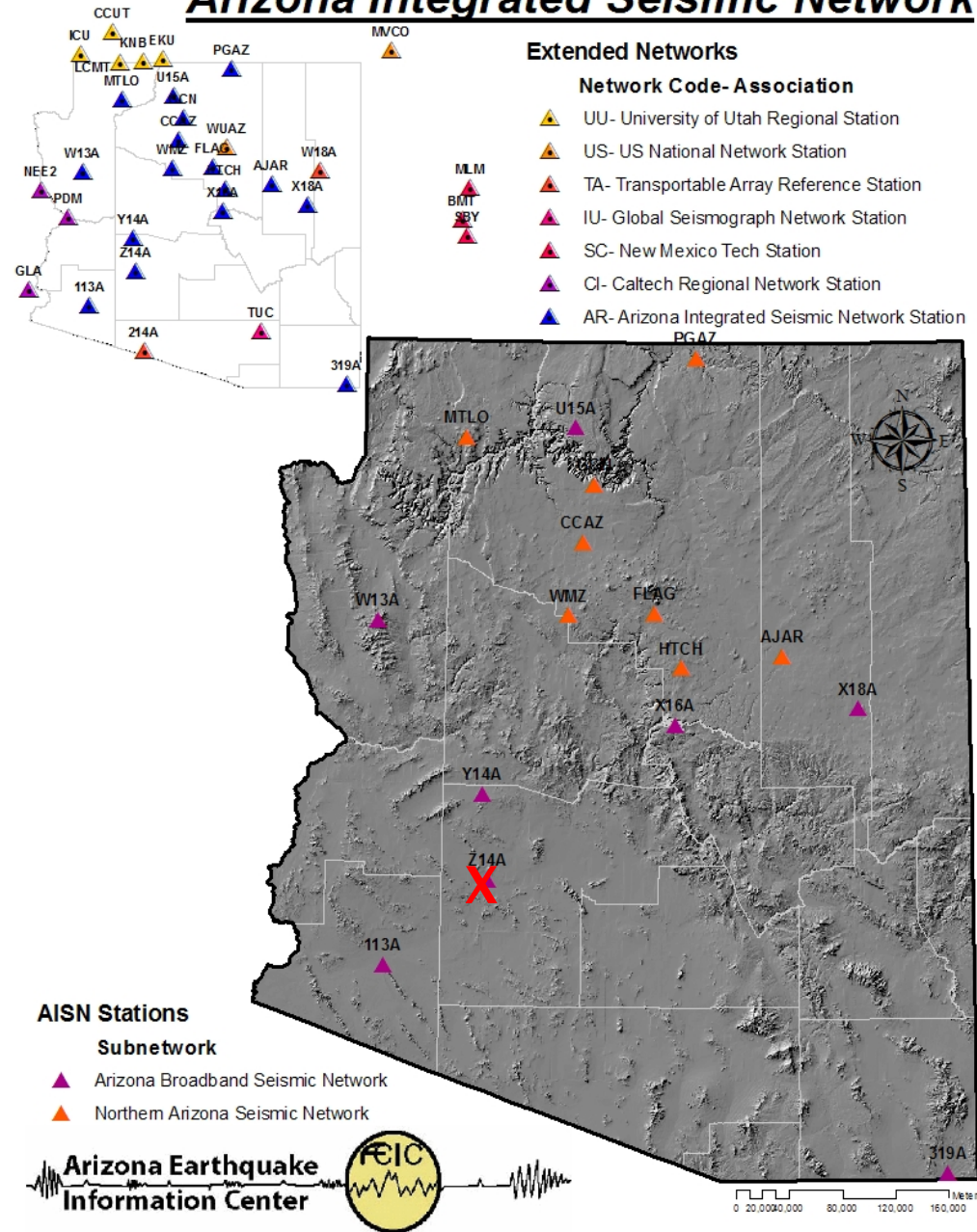
- Flagstaff area cluster

1950 to present

- Moderate seismicity mainly in northern AZ
- Absence of seismicity in much of SW AZ



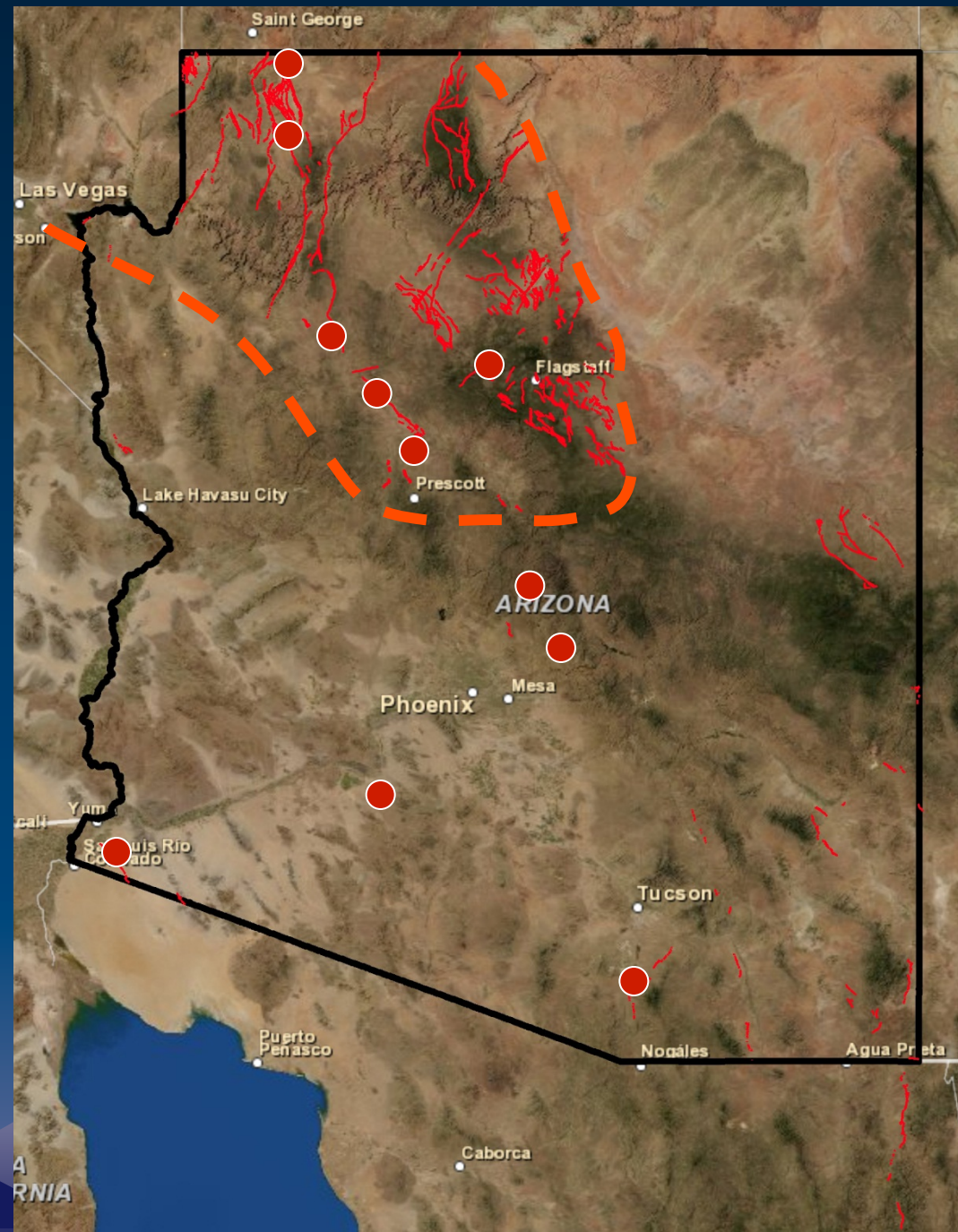
Arizona Integrated Seismic Network



- 7 newly acquired TA broadband seismometers
- Complements existing broadband and analog stations
- Collaborative effort between the AZGS and the three universities (NAU, UA and ASU)
- Funded mainly by FEMA with state, private contributions
- Better characterize seismicity and provide adequate threshold of detection (~M 3?)
- *Will we be able to maintain it?*

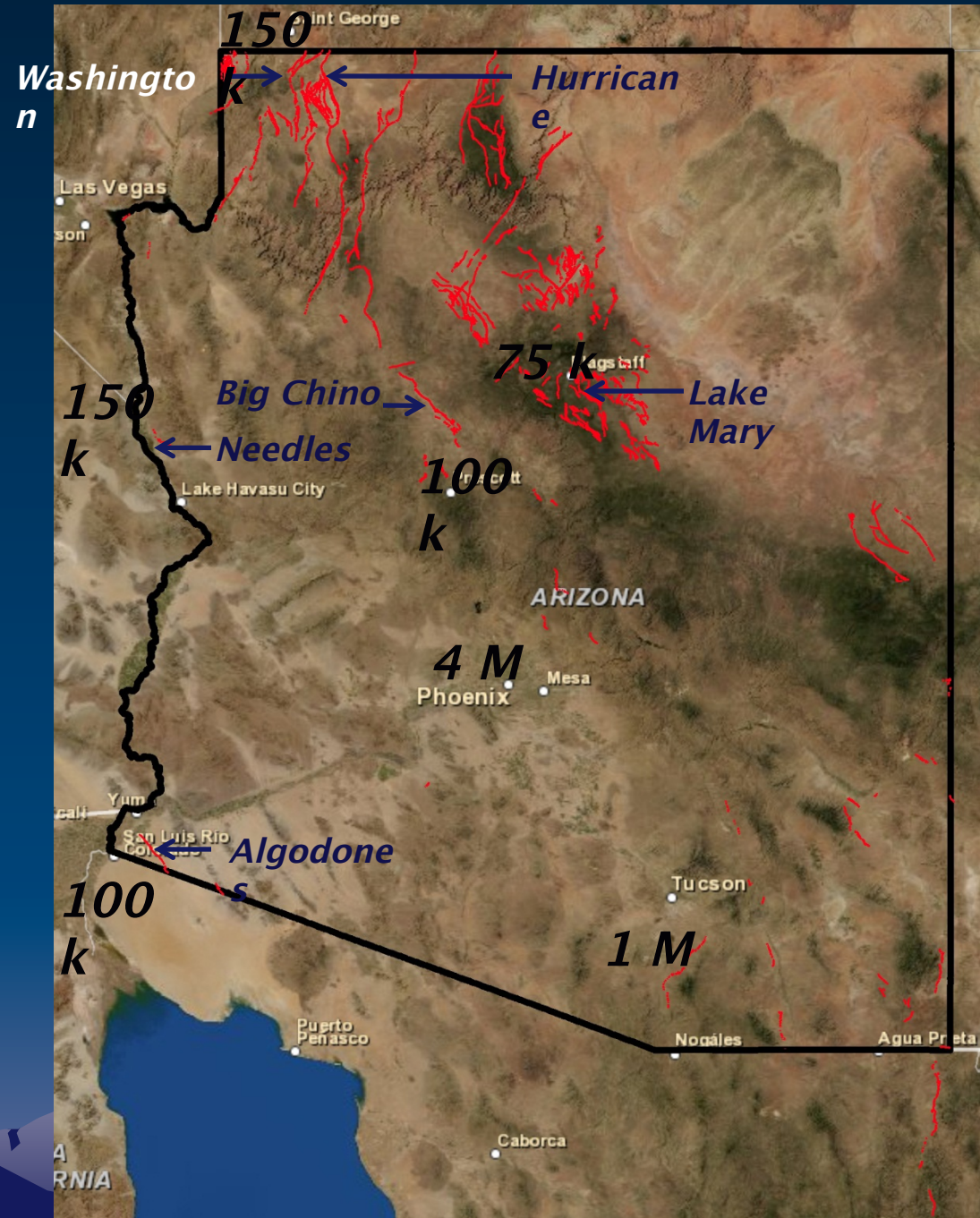
Quaternary Faults in AZ

- concentrated along SW Colorado Plateau margin
- almost none in SW AZ
- ~30 faults definitely active in past 130 k.y.
- low slip rates
- ~11 faults trenched – most barely studied

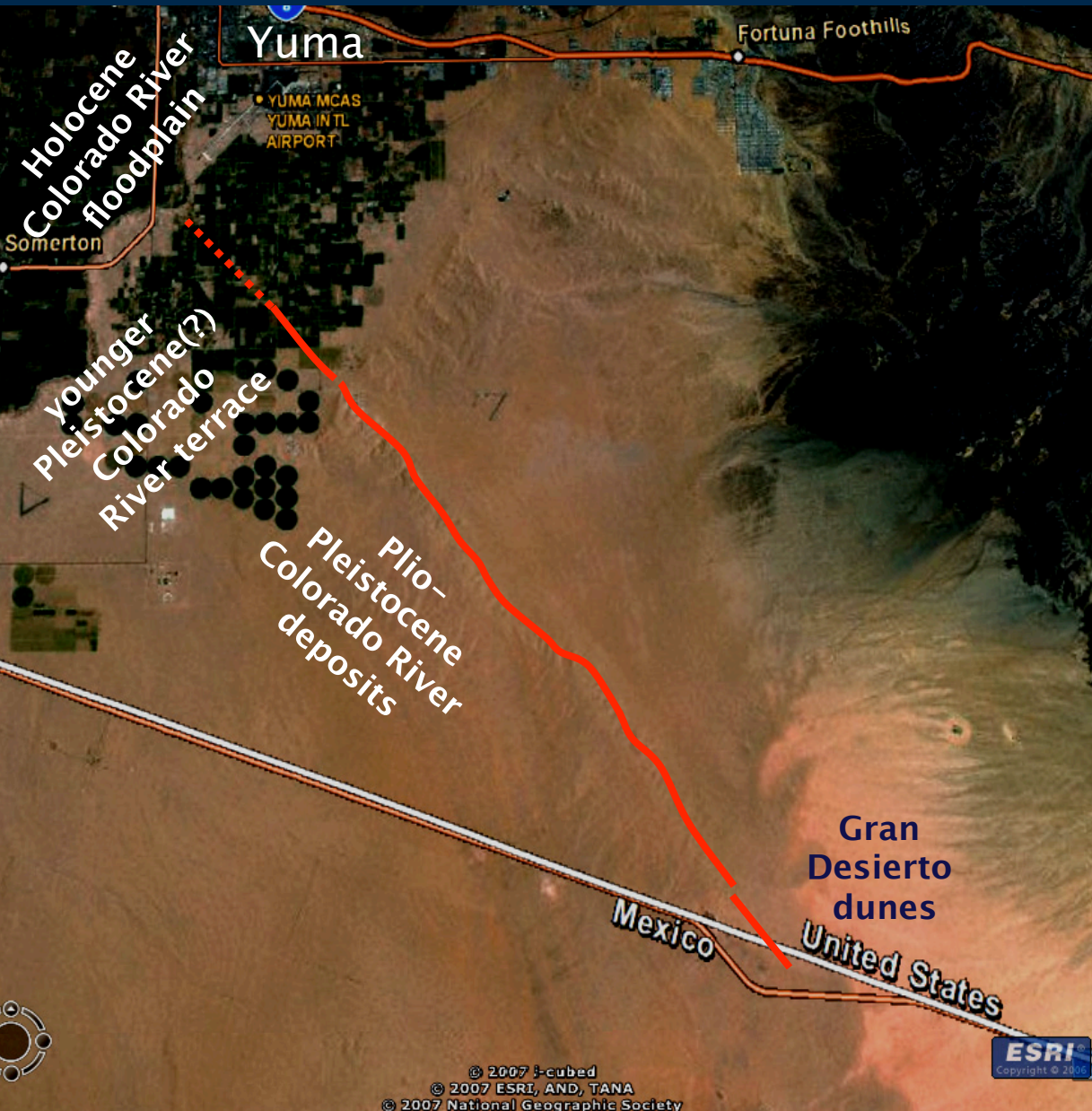


Most hazardous faults in AZ

- Algodones – Yuma
- Needles – Mohave Valley
- Big Chino – Prescott
- Lake Mary – Flagstaff
- Hurricane and Washington – St. George area



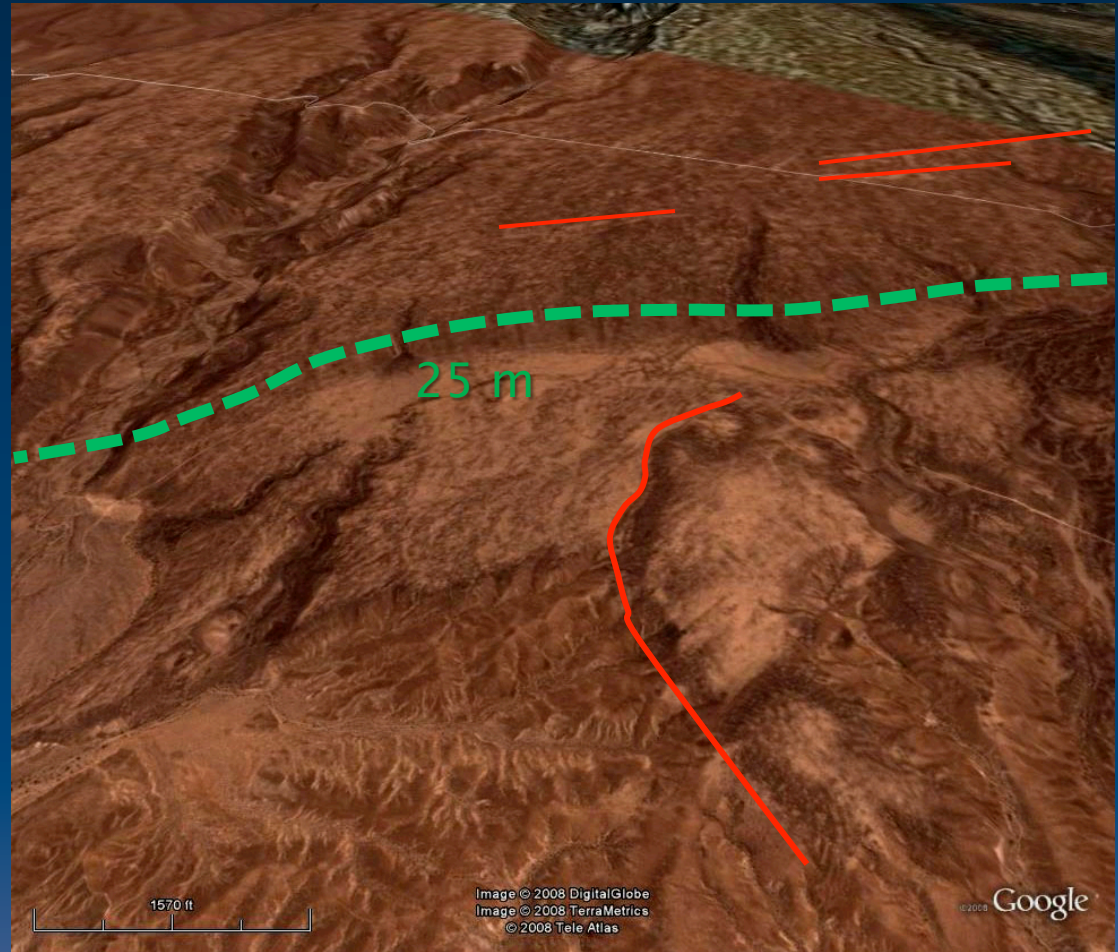
Algodones fault



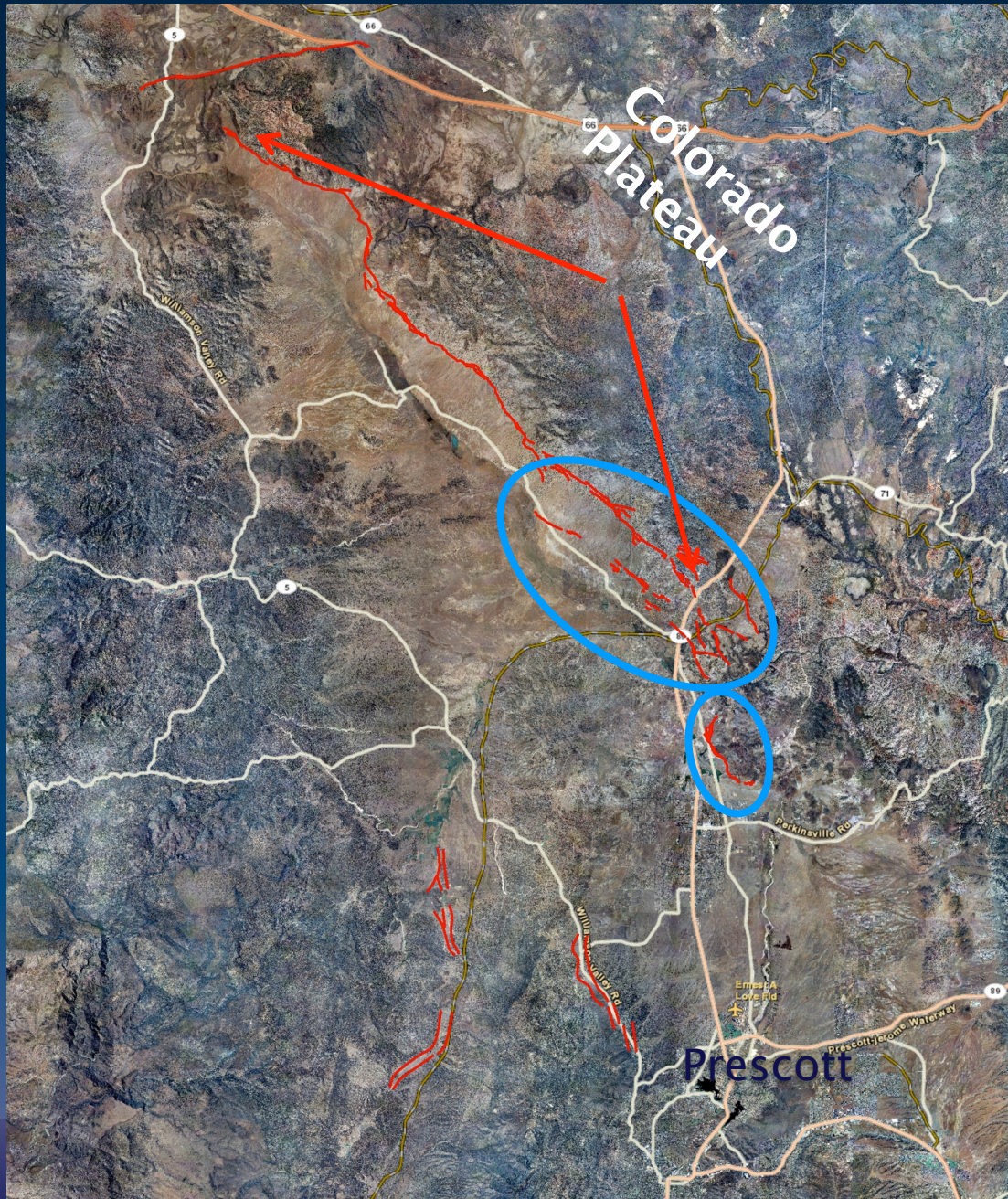
- Margin of Yuma metro area
- aligned w/ San Andreas to NW
- At least 15 m vertical displacement of *older Pleistocene to Pliocene* river deposits
- Minimal vertical displacement of late Pleistocene terrace
- Altho active in late Pleistocene, slip rate likely less than previously thought

Needles deformation zone

- Graben is wrinkle on back of larger ~fold
- > 25 m vertical displacement of early to middle Pleistocene alluvial fan
- Substantially greater tilting of Pliocene river deposits
- More faulting than previously recognized – total zone length at least 20 km
- ***ADOT interest, but how to study?***



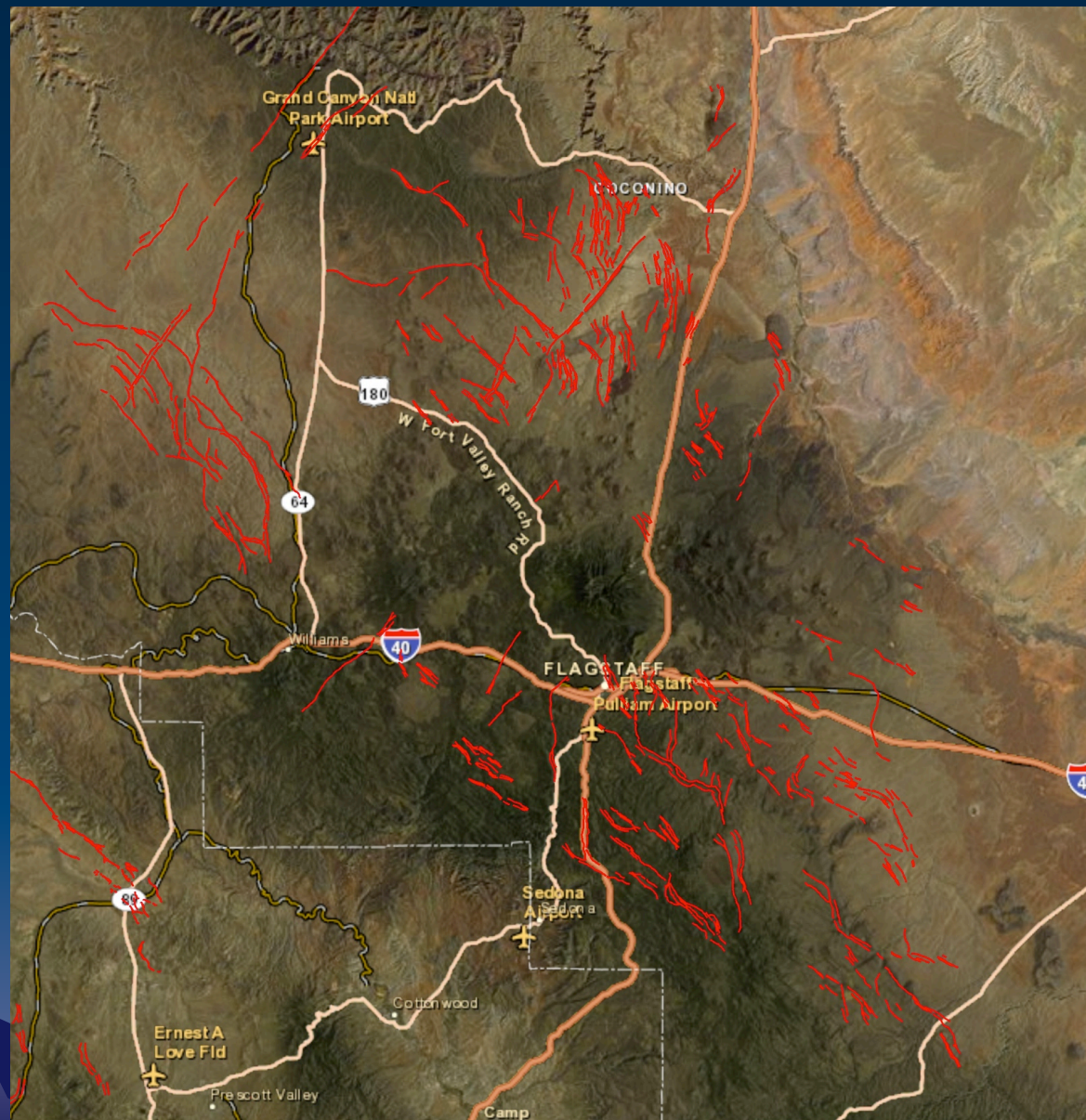
Big Chino fault



- Fault zone along SW margin of Colorado Plateau
- ~ 50 km fault zone length
- Recent geologic mapping added detail and length to southern end
- Newly discovered Little Chino fault zone – related to Big Chino?
- 65 km–long rupture possible?

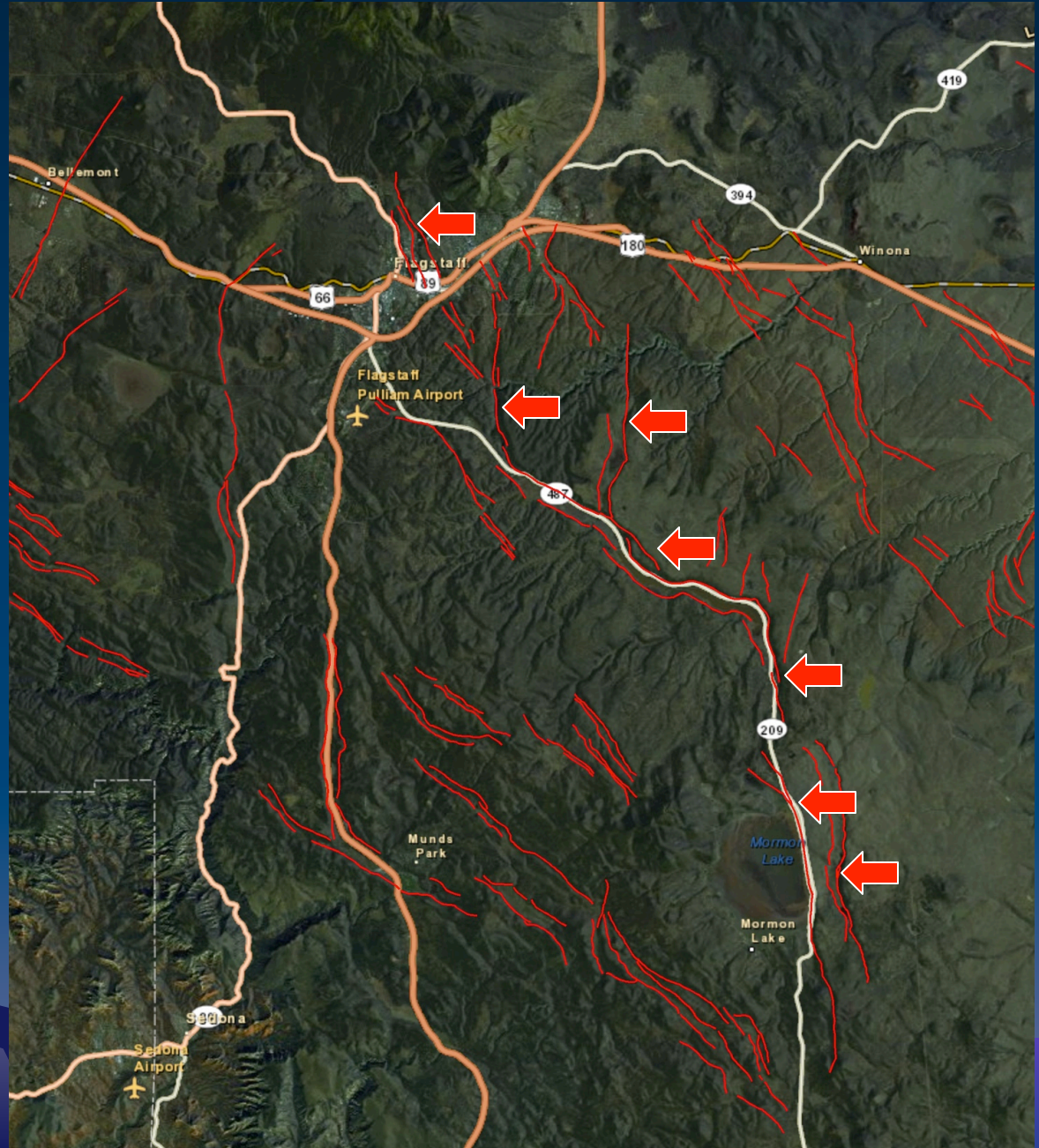
Flagstaff – Grand Canyon area

- More faults in new (in progress) Q fault compilation for AZ
 - bedrock fault escarpments
 - paucity of young deposits, some faults displace Q volcanics
 - concerns about inconsistent inclusion of faults in previous compilation
- *Seismic source zones?*
- *Ramifications of many low-slip-rate faults?*



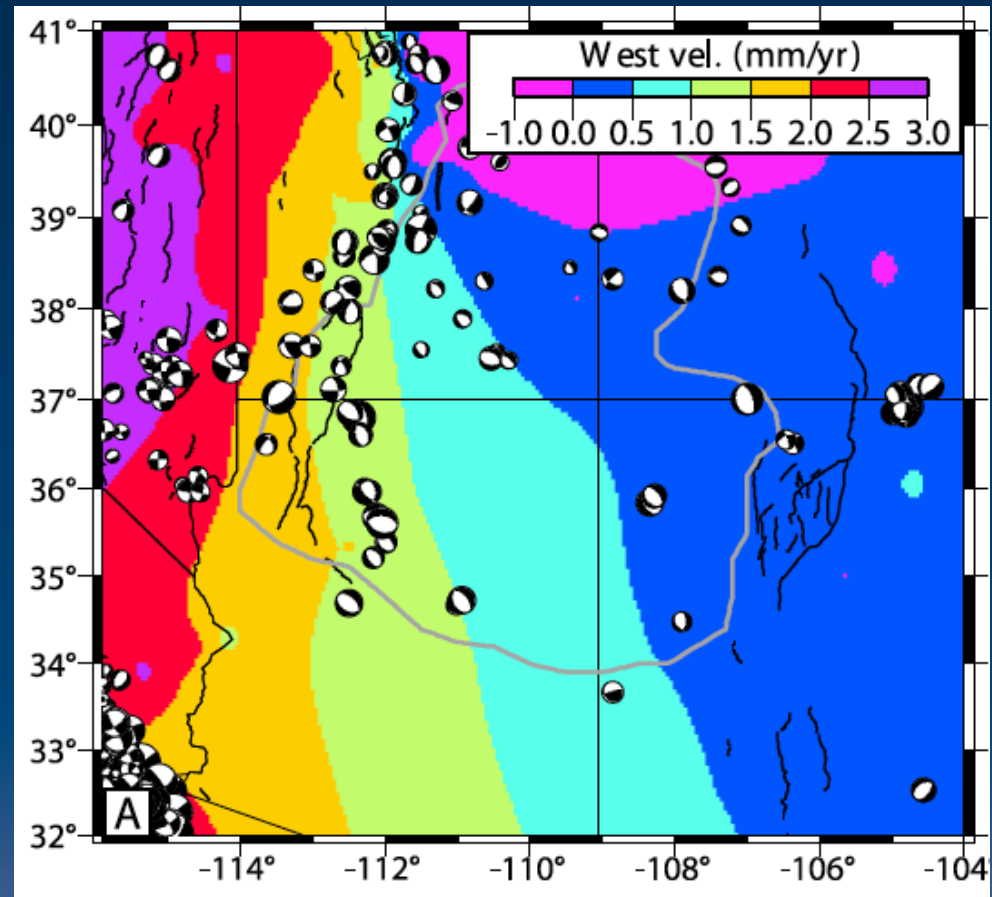
Lake Mary fault

- Prominent fault escarpment SE of Flagstaff
- Possible fault splays thru center of city
- ~130 m vertical displacement of ~6 Ma basalt, minimum 0.02 m/kyr rate
- ***Age of youngest rupture? Length and complexity of surface ruptures?***



Prelim Geodetic Observations

- E–W crustal velocity gradient across AZ
- Doesn't correspond closely w/ Q fault concentrations or historical seismicity



Crustal Velocities

- Increasing NW-directed strain across southern AZ
- A region with little evidence of recent deformation
- Have we missed subtle evidence of Q faulting?

