Continental Basin Development in the Central Basin and Range Province Part I: Stratigraphic Record of Basin and Range Extension in the Late Oligocene and Early Miocene in the Yucca Mountain Area, Nevada, USA

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32nd International Geologic Congress

August, 2004

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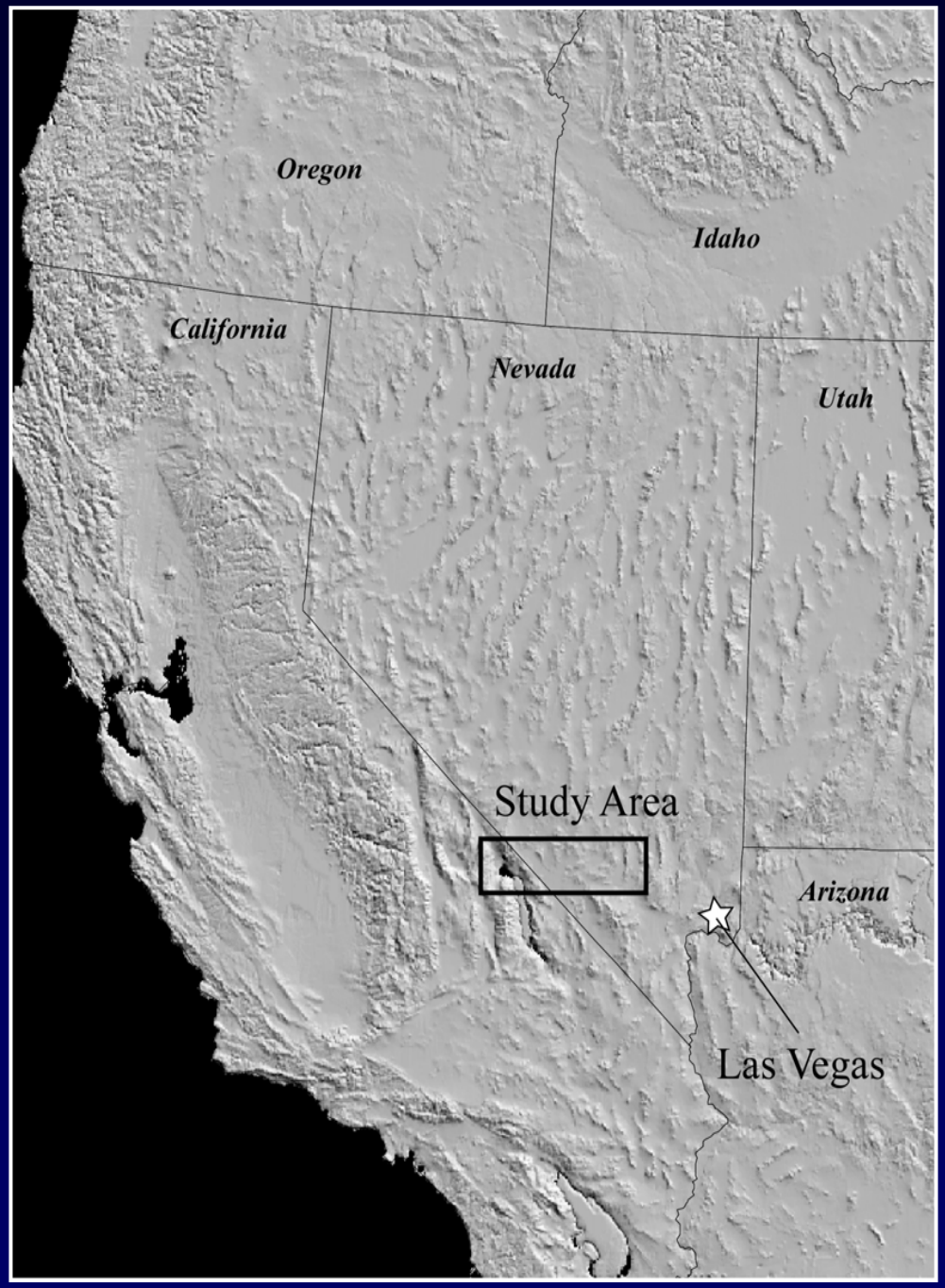
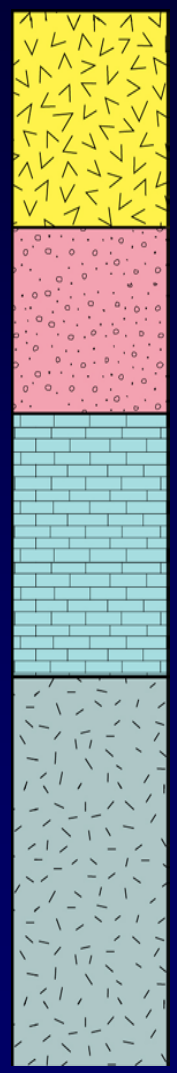
Study area is located in the Basin and Range Province of the western United States



Generalized Stratigraphic Column



Middle Miocene to Quaternary sedimentary and volcanic strata

Oligocene-lower Miocene sedimentary and volcanic strata

Paleozoic sedimentary strata (mainly carbonate rocks)

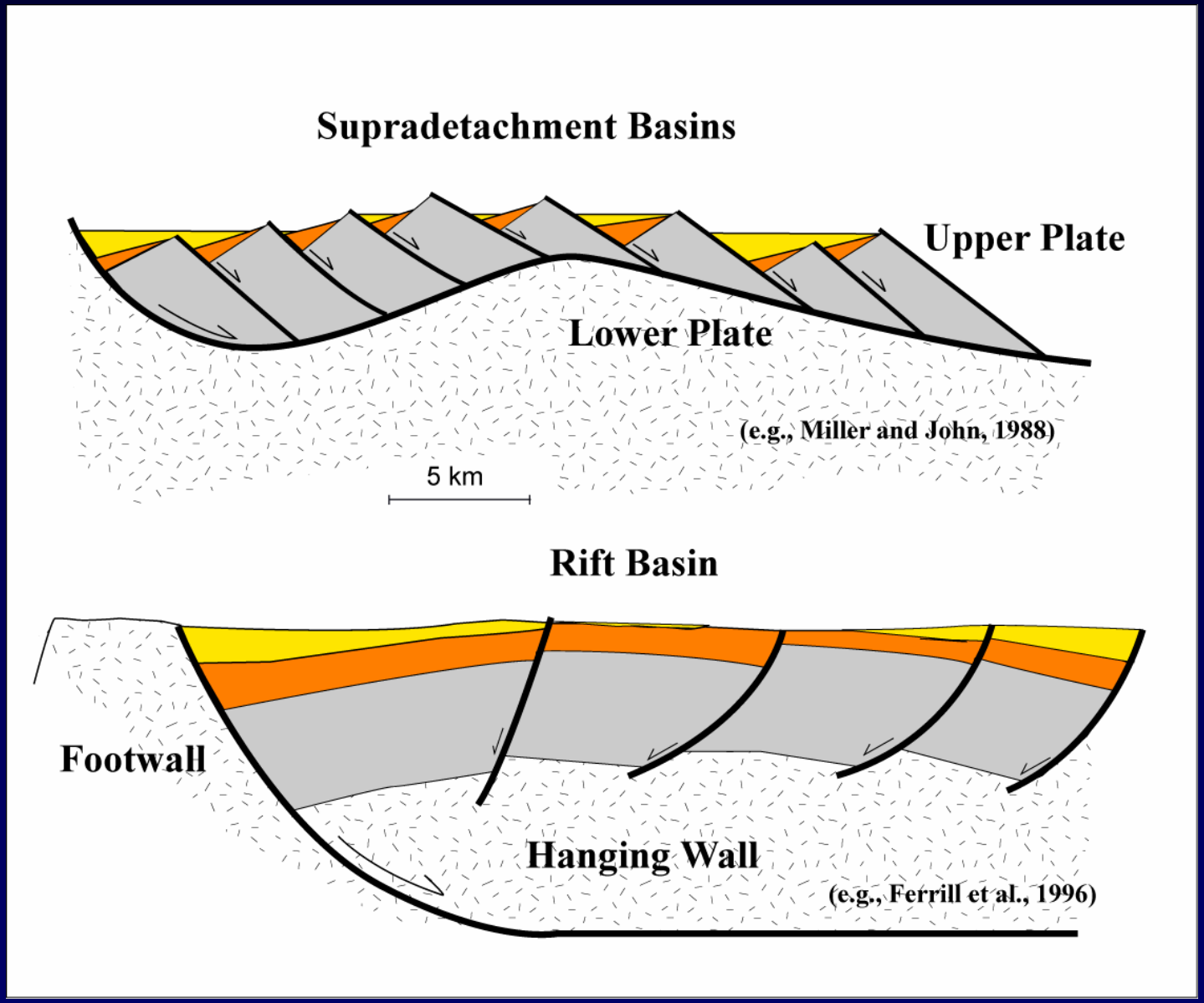
Precambrian-Cambrian metamorphic strata (marble and quartzite)

5000 m

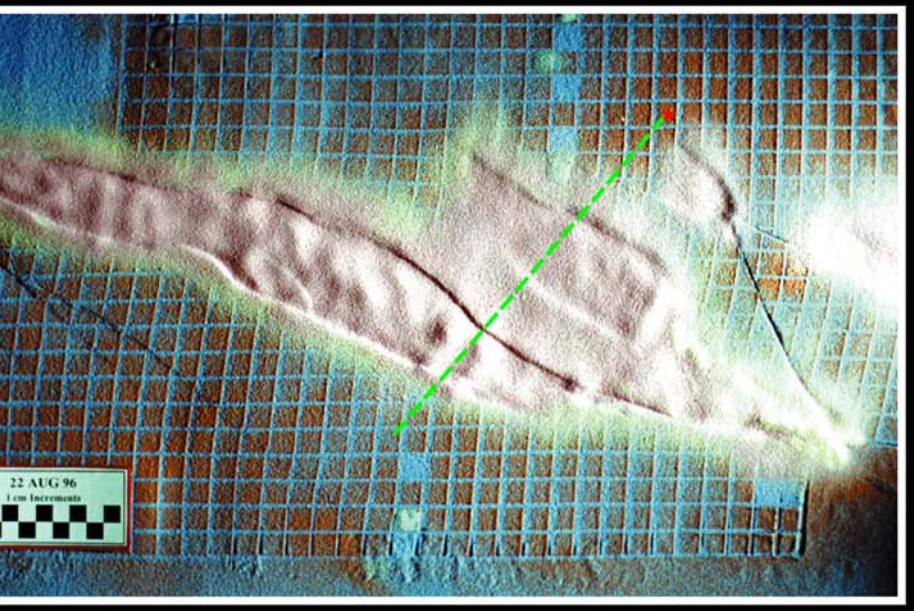
Objective

- Examine geologic record of Tertiary extensional deformation and basin development in the region surrounding potential high-level waste repository at Yucca Mountain, Nevada
  - Oligocene and early Miocene (first talk)
  - Middle Miocene to Quaternary (second talk)
- These Tertiary rocks are important to Yucca Mountain studies:
  - Comprise much of the basin fill down-gradient from the potential repository (e.g., as applied to hydrogeologic models of basin fill)
  - Provide the framework for understanding seismotectonics (e.g., as applied to earthquake and faulting hazard studies)

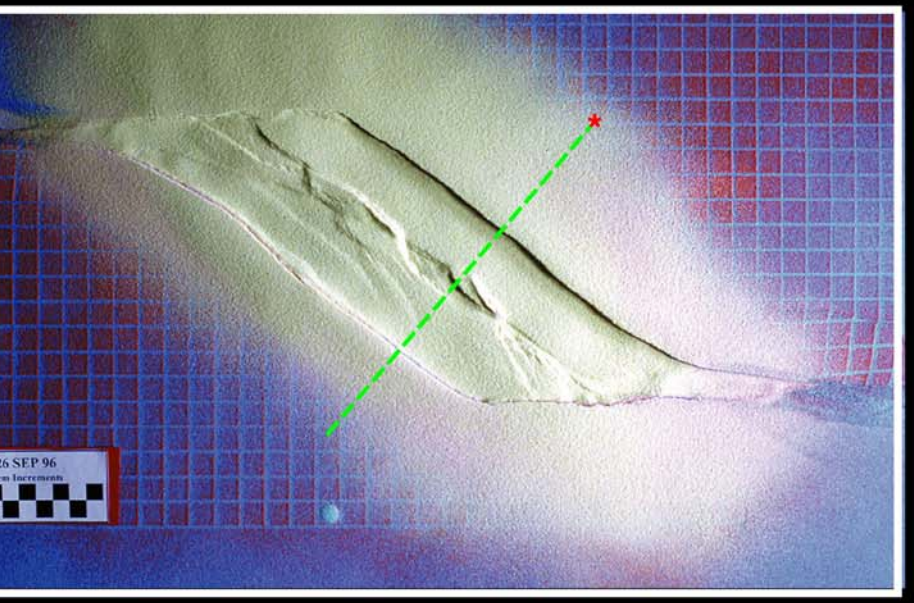
Basin Development Reflects Faulting Style



Basin Development Reflects Detachment Properties



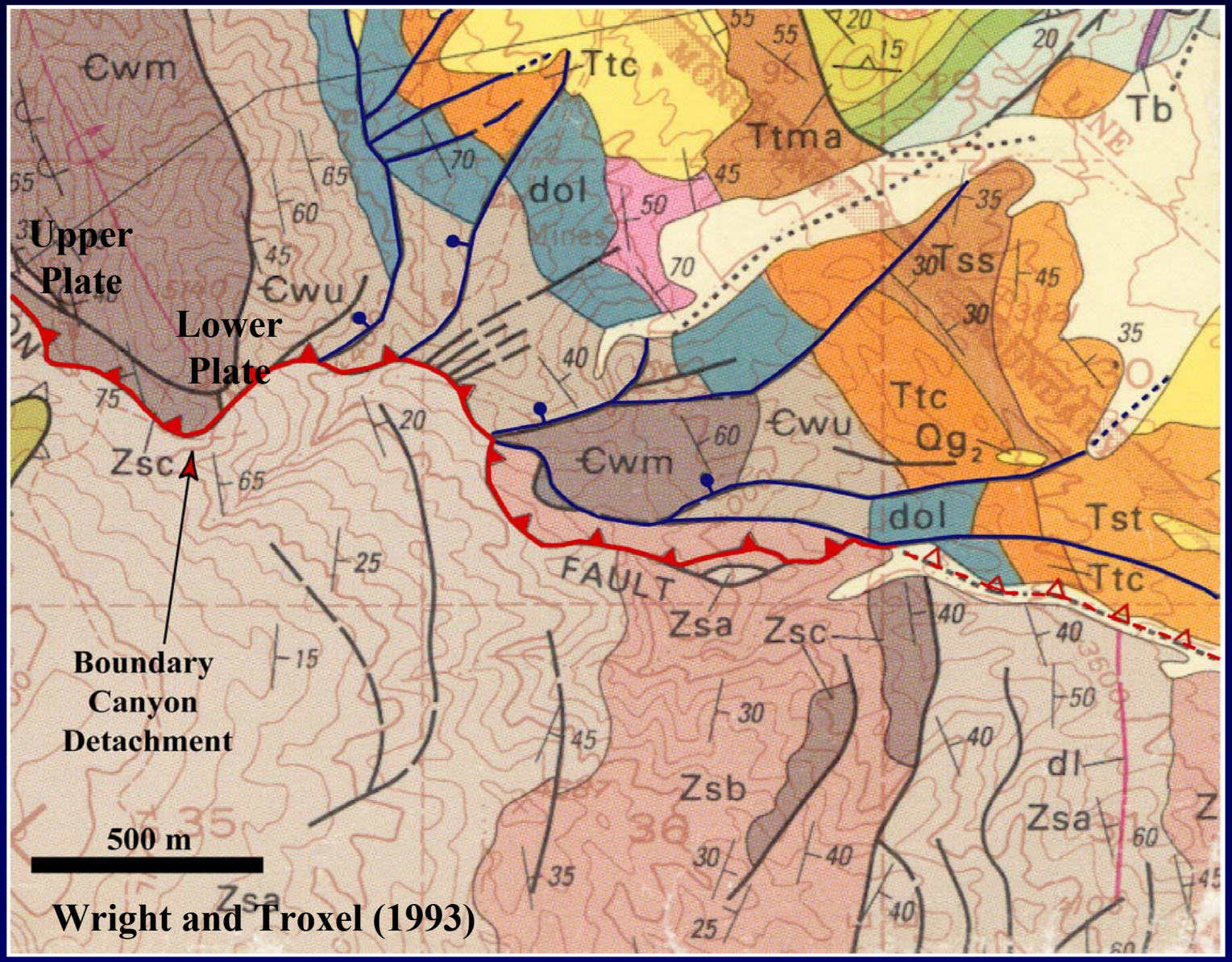
Ductile detachment
(supradetachment basins)



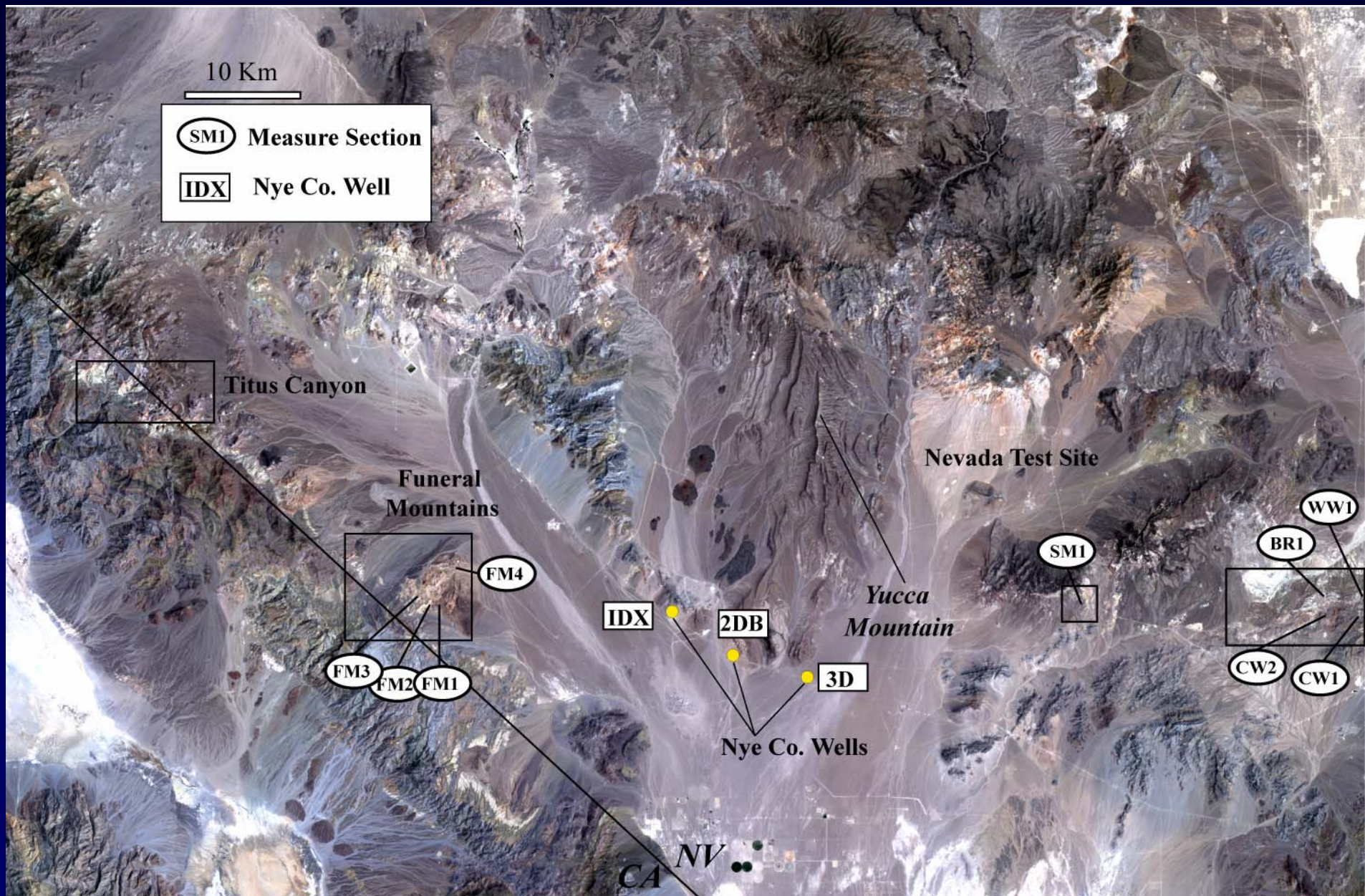
Rigid detachment (rift basins)

(Sims et al., 1998)

Boundary Canyon Detachment with Normal Faults in the Upper Plate



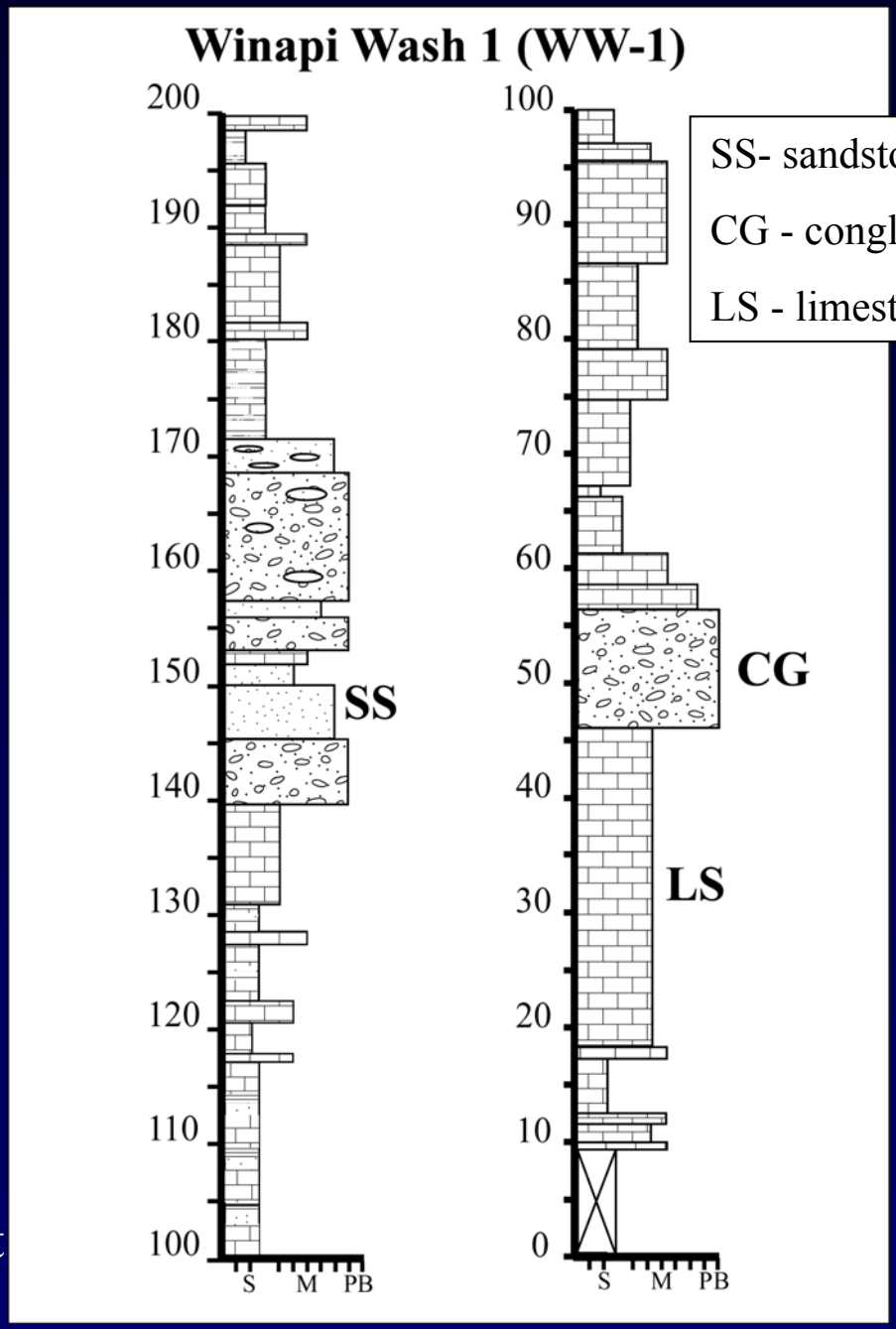
Distribution of Oligocene and Early Miocene Strata

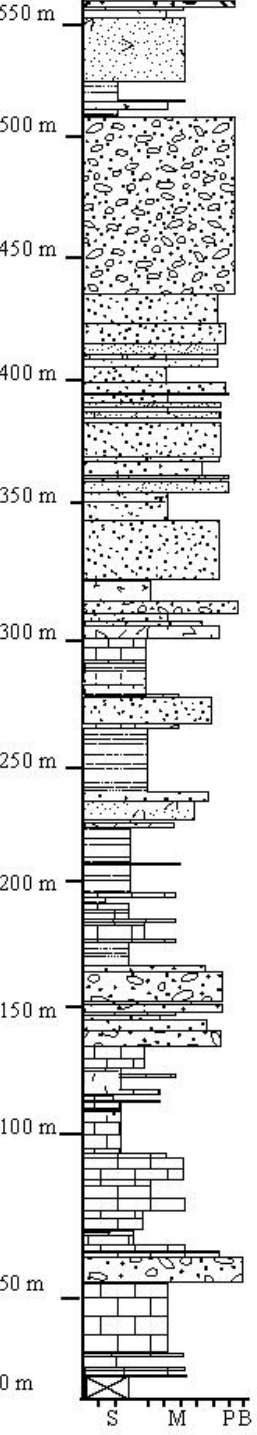


Measured Sections

Key Observations

- Non-marine limestone
- Matrix and clast-supported conglomerates
- Sandstone compositions
- Conglomerate clast composition and color changes
- Transition to volcanic component





Three Lithofacies Associations

LA-3. Upper part of the section dominated by tuff and volcaniclastic sandstone

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LA-2. Middle part of the section dominated by red clast-supported conglomerate and red fine- to coarse-grained sandstone

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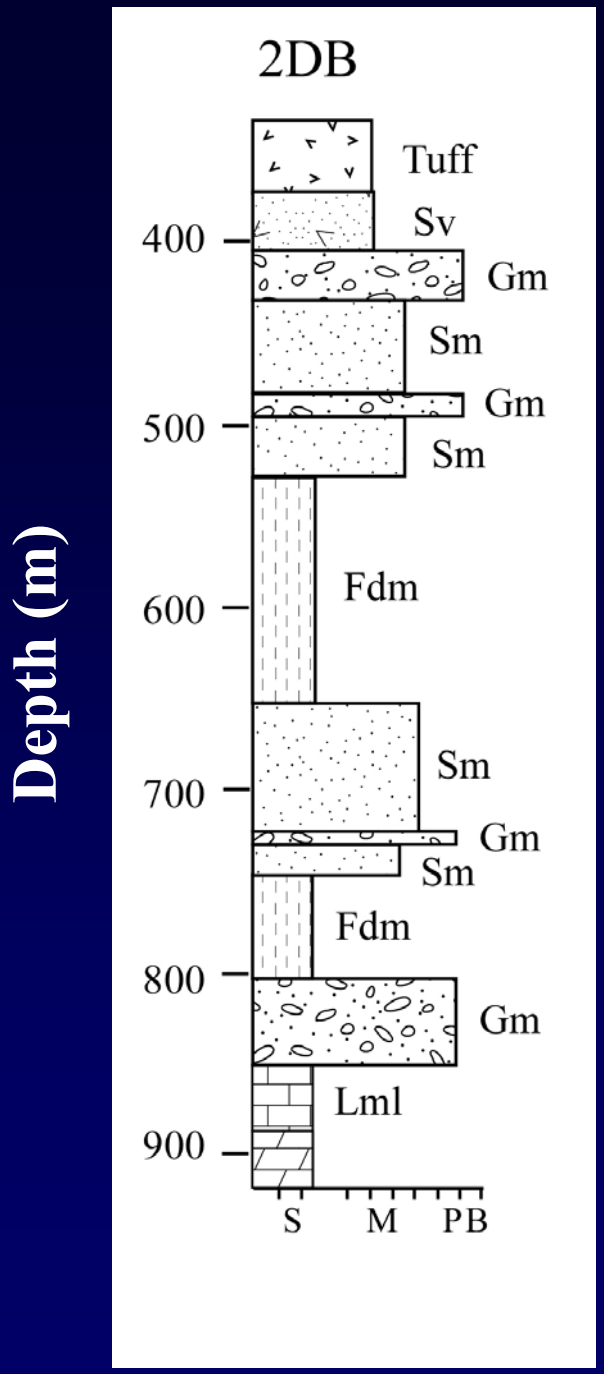
LA-1. Lower part of the section dominated by white to brown fossiliferous limestone and matrix supported conglomerate

Nye County Well

NC EWDP 2DB



LA3 - Tuff and volcaniclastic sandstone

LA2 - Red sandstone and red conglomerate with quartzite and carbonate clasts

LA1 - White to brown fossiliferous limestone and matrix-supported conglomerate

Lithofacies Association 1

- Bedded limestone

Lithofacies Association 1

- Deformed quartzite conglomerate

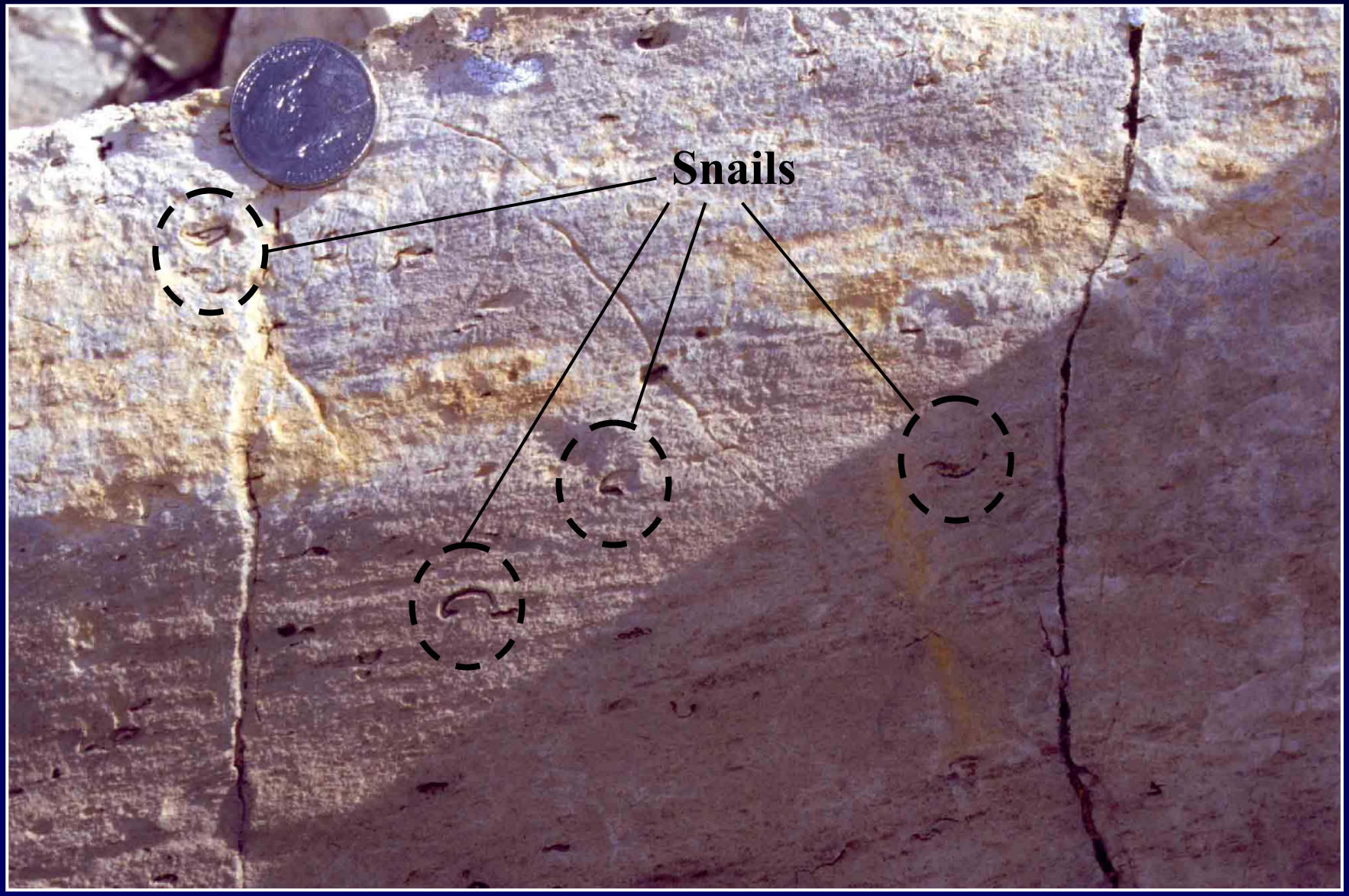
- Matrix-supported conglomerate

Lithofacies Association 1

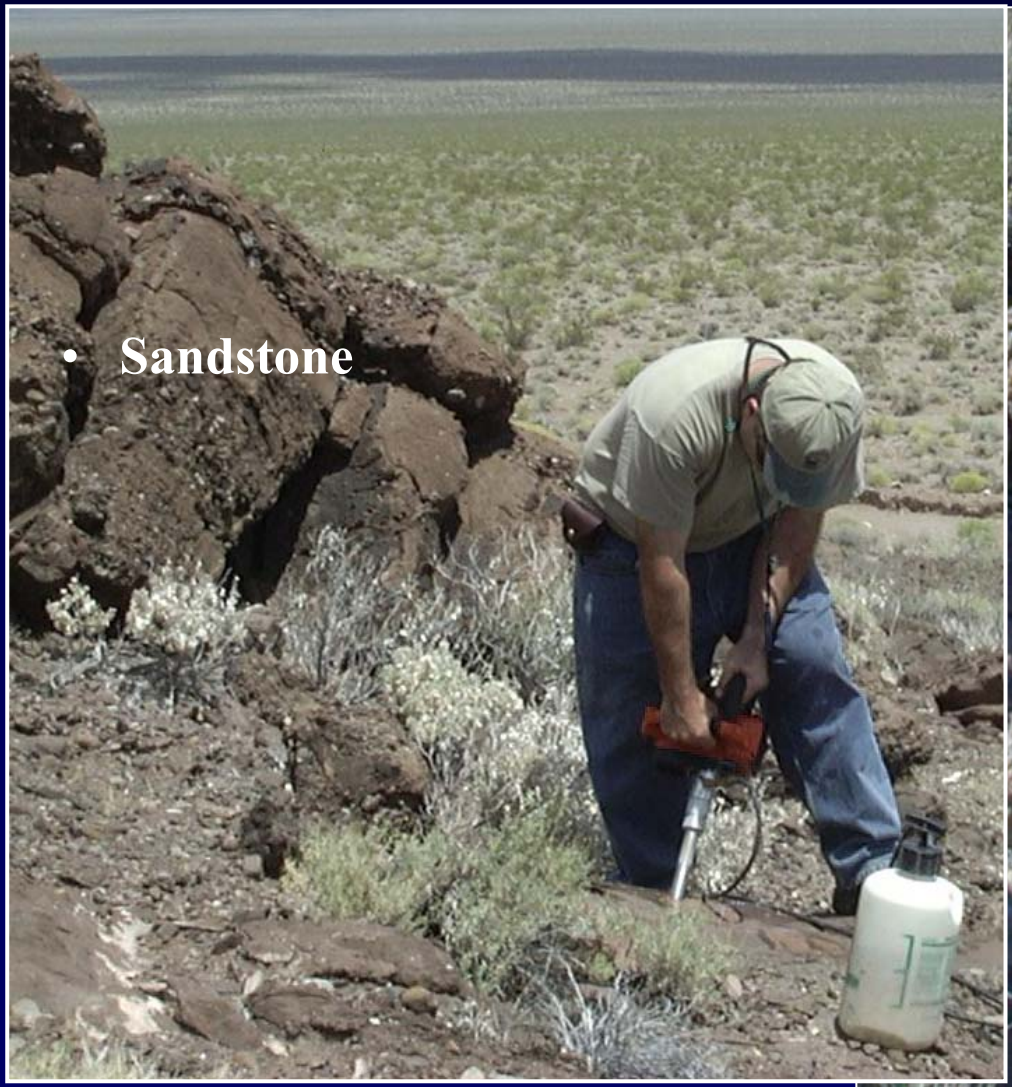
- **Stromatolite**

Lithofacies Association 1

Lithofacies Association 1



Lithofacies Association 2



Lithofacies Association 3

- Volcaniclastic sandstone

- Tuff

Conclusions

- Three lithostratigraphic units correspond to three stages of supradetachment basin development.

  LA1 - isolated lacustrian basins with limited sediment flux

  LA2 - development of through-going fluvial systems

  LA3 - thinned crust and initiation of volcanism

- Recognition of the lateral extent and thickness of these units is important to support reliable groundwater models in performance assessment calculations of a potential repository at Yucca Mountain.

References

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