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# Lithostratigraphic Correlation of Upper Paleozoic Sandstone Bodies in the Western United States with Special Emphasis on the Coconino Sandstone

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# LITHOSTRATIGRAPHIC CORRELATION OF UPPER PALEOZOIC SANDSTONE BODIES IN THE WESTERN UNITED STATES WITH SPECIAL EMPHASIS ON THE COCONINO SANDSTONE

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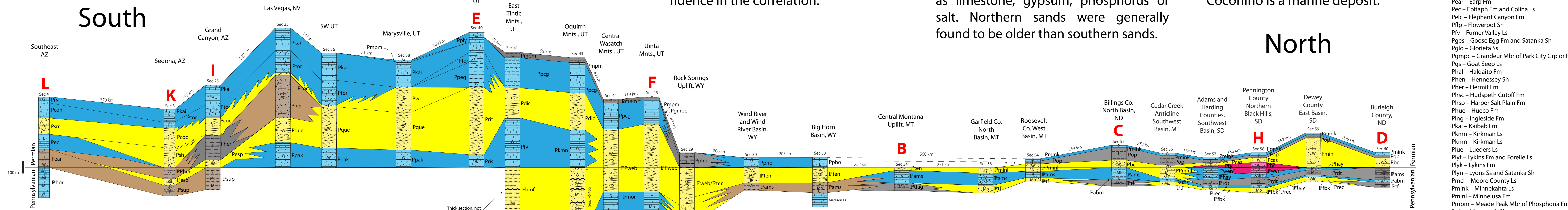
**Purpose:**  
To find the extent and equivalent units of the Coconino Sandstone of northern Arizona.

**Methods:**  
Generalized stratigraphic sections were located from various publications (the *COSUNA* and *RMAG* data, for example), drawn and then correlated. Sections were "hung" on the Permian-Pennsylvanian boundary and were spaced accordingly. Marker beds such as gypsum, salt, or limestone were used to develop confidence in the correlation.

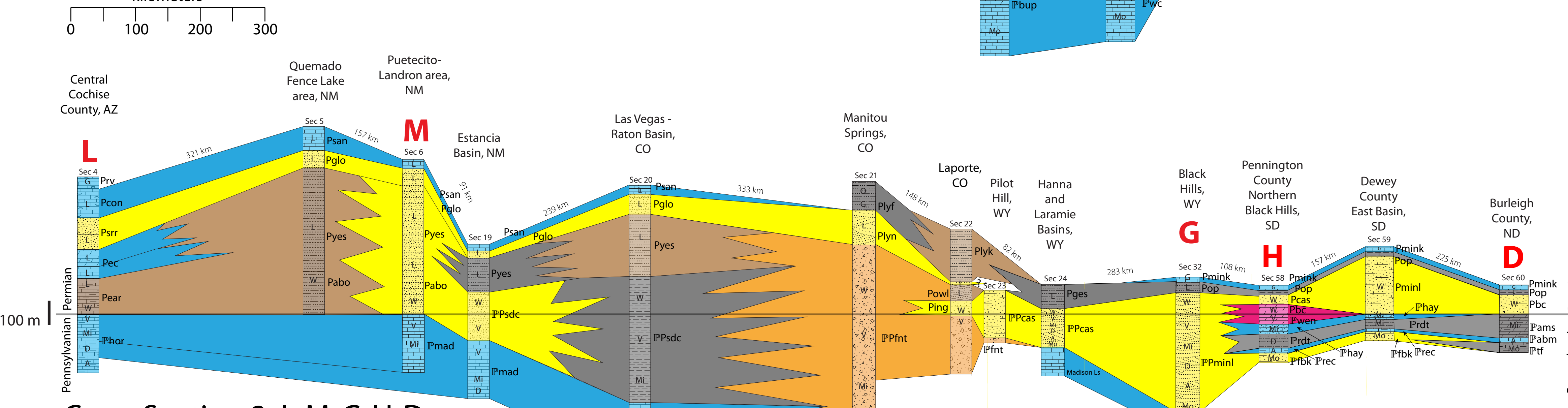
**Results:**  
It was found sandstones (yellow units below) equivalent to the Coconino could be traced from California and northern Arizona to the Dakotas on both the east and west sides of the Rocky Mountains, covering up to 2.5 million km<sup>2</sup>. Correlative sands usually lie directly in the vicinity of a significant chemical deposit such as limestone, gypsum, phosphorus or salt. Northern sands were generally found to be older than southern sands.

**Implications:**  
The Coconino is usually cited as a "type" example of an eolian sandstone. However, it correlates with many units that are clearly marine making a relatively continuous sand body that covers much of the western U.S. This is consistent with other sedimentological data that suggests the Coconino is a marine deposit.

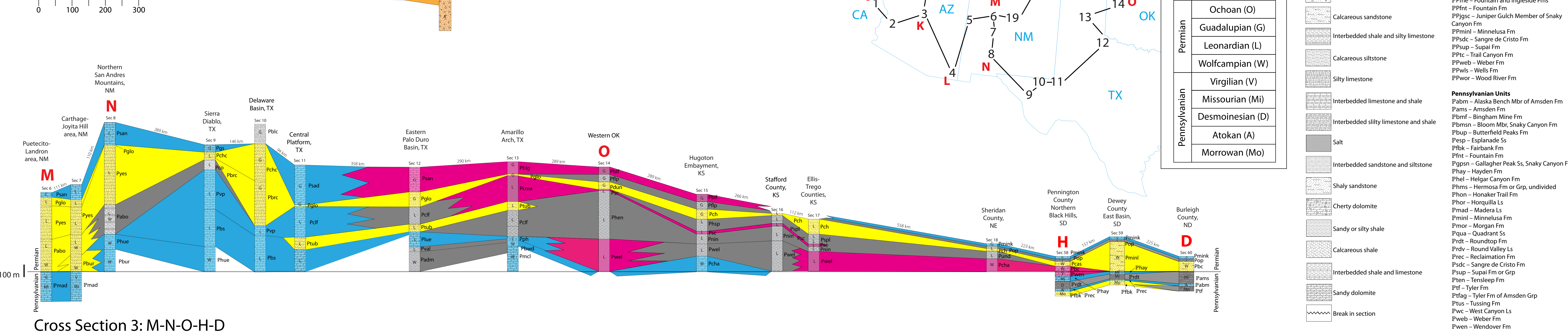
- Permian Units**
  - Pabo - Abo Fm
  - Padm - Admiral Fm
  - Pbc - Broom Creek Fm
  - Pblc - Bell Canyon Fm
  - Pblf - Blaine Fm
  - Pblg - Blaine Gyp
  - Pbr - Brushy Canyon Fm
  - Pbs - Bone Spring Ls
  - Pbur - Bursum Fm
  - Pbvd - Brown and White Dol
  - Pcas - Cassa Fm
  - Pch - Cedar Hills Fm
  - Pcha - Chase Grp
  - Pchc - Cherry Canyon Fm
  - Pcf - Clear Fork Grp
  - Pcm - Cedar Mesa Ss
  - Pcma - Cimarron Anh
  - Pco - Cutoff Sh
  - Pcoc - Coconino Ss
  - Pcon - Concha Ls
  - Pdc - De Chelly Ss
  - Pdk - Diamond Creek Ss
  - Pdun - Duncan Ss
  - Pear - Earp Fm
  - Pec - Epitaph Fm and Colina Ls
  - Pek - Elephant Canyon Fm
  - Pflp - Flowerpot Sh
  - Pfv - Furner Valley Ls
  - Pges - Goose Egg Fm and Satanka Sh
  - Pgl - Glorieta Ss
  - Pgm - Grandeur Mbr of Park City Grp or Fm
  - Pgs - Goat Sheep Ls
  - Phal - Halcato Fm
  - Phen - Hennessey Sh
  - Pher - Hermit Fm
  - Phsc - Hudspeeth Cutoff Fm
  - Phsp - Harper Salt Plain Fm
  - Phue - Huaco Fm
  - Plng - Ingleside Fm
  - Pkai - Kaibab Fm
  - Pkmm - Kirkman Ls
  - Pknn - Kirkman Ls
  - Ply - Lyons Ss and Satanka Sh
  - Pmcl - Moore County Ls
  - Pmnk - Minnekahta Ls
  - Pmnl - Minnelusa Fm
  - Pmpm - Meade Peak Mbr of Phosphoria Fm
  - Pnn - Ninescah Sh
  - Pop - Opeche Sh
  - Por - Organ Rock Sh
  - Powl - Owl Canyon Fm
  - Ppak - Pakoon Ls
  - Ppcg - Park City Grp or Fm
  - Ppcph - Park City and Phosphoria Fm
  - Ppcs - Pole Creek Sequence
  - Ppeq - Pequo Fm
  - Pph - Panhandle Ls
  - Ppho - Phosphoria Fm
  - Pply - Plympton Fm
  - Pque - Queantowep Ss
  - Pris - Riepe Spring Ls
  - Prit - Riepetown Ss
  - Pry - Rain Valley
  - Psad - San Andres Dol
  - Psan - San Andres Fm
  - Psc - Stone Coral Fm
  - Psh - Schnebly Hill Fm
  - Pshn - Shedhorn Ss
  - Psl - Salt Plain Fm
  - Psr - Scherrer Fm
  - Ptor - Torowep Fm
  - Ptub - Tub Ss Mbr of Clear Fork Grp
  - Pund - undifferentiated
  - Pval - Valera Fm
  - Pvp - Victoria Peak Ls
  - Pwel - Wellington Fm
  - Pwr - White Rim Ss
  - Pyes - Yeso Fm
- Permian/Pennsylvanian Units**
  - PPcas - Casper Fm
  - PPfne - Fountain and Ingleside Fms
  - PPfnt - Fountain Fm
  - PPjgc - Juniper Gulch Member of Snaky Canyon Fm
  - PPmnl - Minnelusa Fm
  - PPsdc - Sangre de Cristo Fm
  - PPsup - Supai Fm
  - PPtc - Trail Canyon Fm
  - PPweb - Weber Fm
  - PPwls - Wells Fm
  - PPwor - Wood River Fm
- Pennsylvanian Units**
  - Pabm - Alaska Bench Mbr of Amsden Fm
  - Pams - Amsden Fm
  - Pbmf - Bingham Mine Fm
  - Pbrms - Bloom Mbr, Snaky Canyon Fm
  - Pbup - Butterfield Peaks Fm
  - Pesp - Esplanade Ss
  - Pfbk - Fairbank Fm
  - PFnt - Fountain Fm
  - Pggsn - Gallagher Peak Ss, Snaky Canyon Fm
  - Phay - Hayden Fm
  - Phel - Helgar Canyon Fm
  - Phms - Hermosa Fm or Grp, undivided
  - Phor - Horquilla Ls
  - Pmad - Madera Ls
  - Pmnl - Minnelusa Fm
  - Pmor - Morgan Fm
  - Pqua - Quadrant Ss
  - Prd - Roundtop Fm
  - Pry - Round Valley Ls
  - Prec - Reclamation Fm
  - Pscd - Sangre de Cristo Fm
  - Psup - Supai Fm or Grp
  - Pten - Tensleep Fm
  - Ptf - Tyler Fm
  - Ptag - Tyler Fm of Amsden Grp
  - Ptus - Tussing Fm
  - Pwc - West Canyon Ls
  - Pweb - Weber Fm
  - Pwen - Wendover Fm



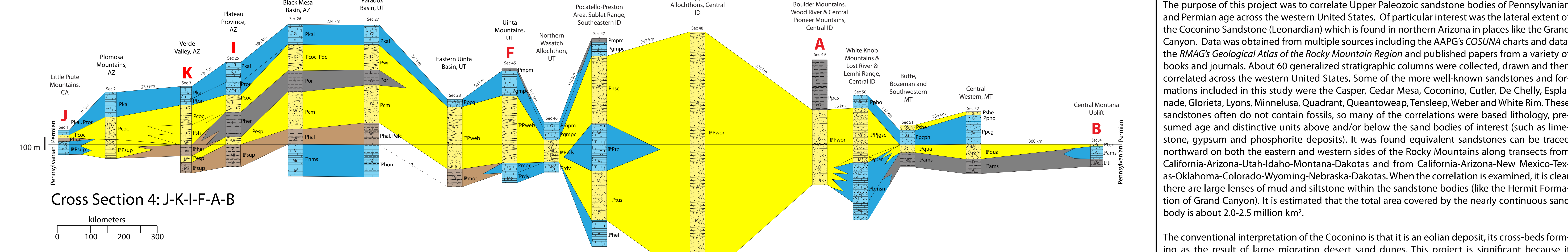
Cross Section 1: L-K-I-E-F-B-C-H-D



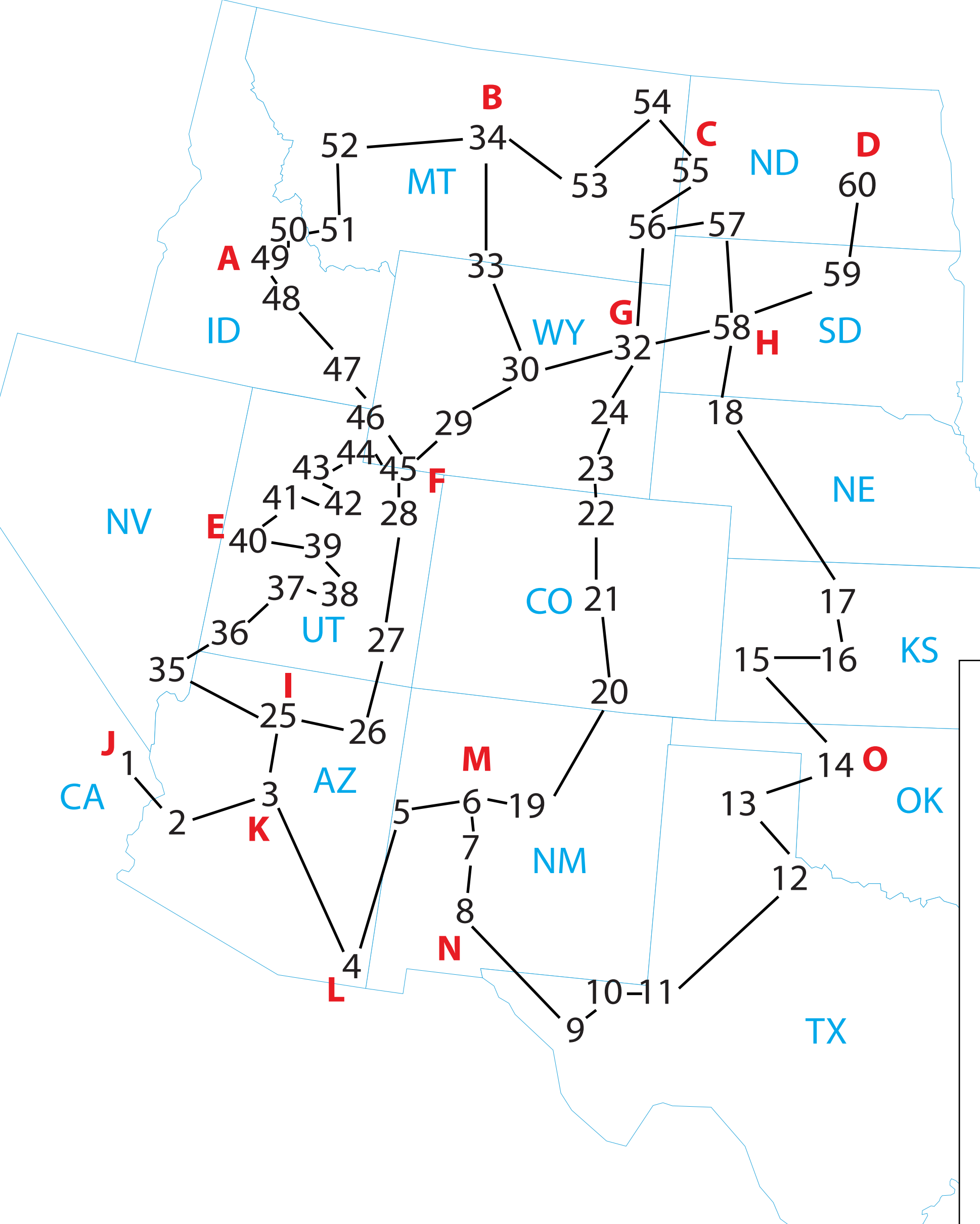
Cross Section 2: L-M-G-H-D



Cross Section 3: M-N-O-H-D



Cross Section 4: J-K-I-F-A-B



**Lithology**

- Limestone
- Sandstone
- Siltstone, shaly silt
- Sandy limestone
- Cross-bedded sandstone
- Cherty limestone
- Shale
- Gypsum
- Dolomite
- Interbedded sandstone and shale
- Dolomitic limestone
- Breccia
- Calcareous sandstone
- Interbedded shale and silty limestone
- Calcareous siltstone
- Silty limestone
- Interbedded limestone and shale
- Interbedded silty limestone and shale
- Salt
- Interbedded sandstone and siltstone
- Shaly sandstone
- Cherty dolomite
- Sandy or silty shale
- Calcareous shale
- Interbedded shale and limestone
- Sandy dolomite
- Break in section

**Colors**

- Arkose
- Sandstone
- Interbedded shale, mud, silt
- Shale, mudstone, siltstone
- Salt or gypsum
- Carbonate

**North American Chronostratigraphic Units**

|               |                  |
|---------------|------------------|
| Permian       | Ochoan (O)       |
|               | Guadalupian (G)  |
|               | Leonardian (L)   |
|               | Wolfcampian (W)  |
|               | Virgilian (V)    |
| Pennsylvanian | Missourian (Mi)  |
|               | Desmoinesian (D) |
|               | Atokan (A)       |
| Morrowan (Mo) |                  |

**Abstract:**  
The purpose of this project was to correlate Upper Paleozoic sandstone bodies of Pennsylvanian and Permian age across the western United States. Of particular interest was the lateral extent of the Coconino Sandstone (Leonardian) which is found in northern Arizona in places like the Grand Canyon. Data was obtained from multiple sources including the AAPG's *COSUNA* charts and data, the *RMAG's Geological Atlas of the Rocky Mountain Region* and published papers from a variety of books and journals. About 60 generalized stratigraphic columns were collected, drawn and then correlated across the western United States. Some of the more well-known sandstones and formations included in this study were the Casper, Cedar Mesa, Coconino, Cutler, De Chelly, Esplanade, Glorieta, Lyons, Minnelusa, Quadrant, Queantowep, Tensleep, Weber and White Rim. These sandstones often do not contain fossils, so many of the correlations were based lithology, presumed age and distinctive units above and/or below the sand bodies of interest (such as limestone, gypsum and phosphorite deposits). It was found equivalent sandstones can be traced northward on both the eastern and western sides of the Rocky Mountains along transects from California-Arizona-Utah-Idaho-Montana-Dakotas and from California-Arizona-New Mexico-Texas-Oklahoma-Colorado-Wyoming-Nebraska-Dakotas. When the correlation is examined, it is clear there are large lenses of mud and siltstone within the sandstone bodies (like the Hermit Formation of Grand Canyon). It is estimated that the total area covered by the nearly continuous sand body is about 2.0-2.5 million km<sup>2</sup>.

The conventional interpretation of the Coconino is that it is an eolian deposit, its cross-beds forming as the result of large migrating desert sand dunes. This project is significant because it demonstrates the lithostratigraphic equivalence of the Coconino with other sandstones that are recognized as being marine, which is consistent with other findings indicating a marine origin for the Coconino.