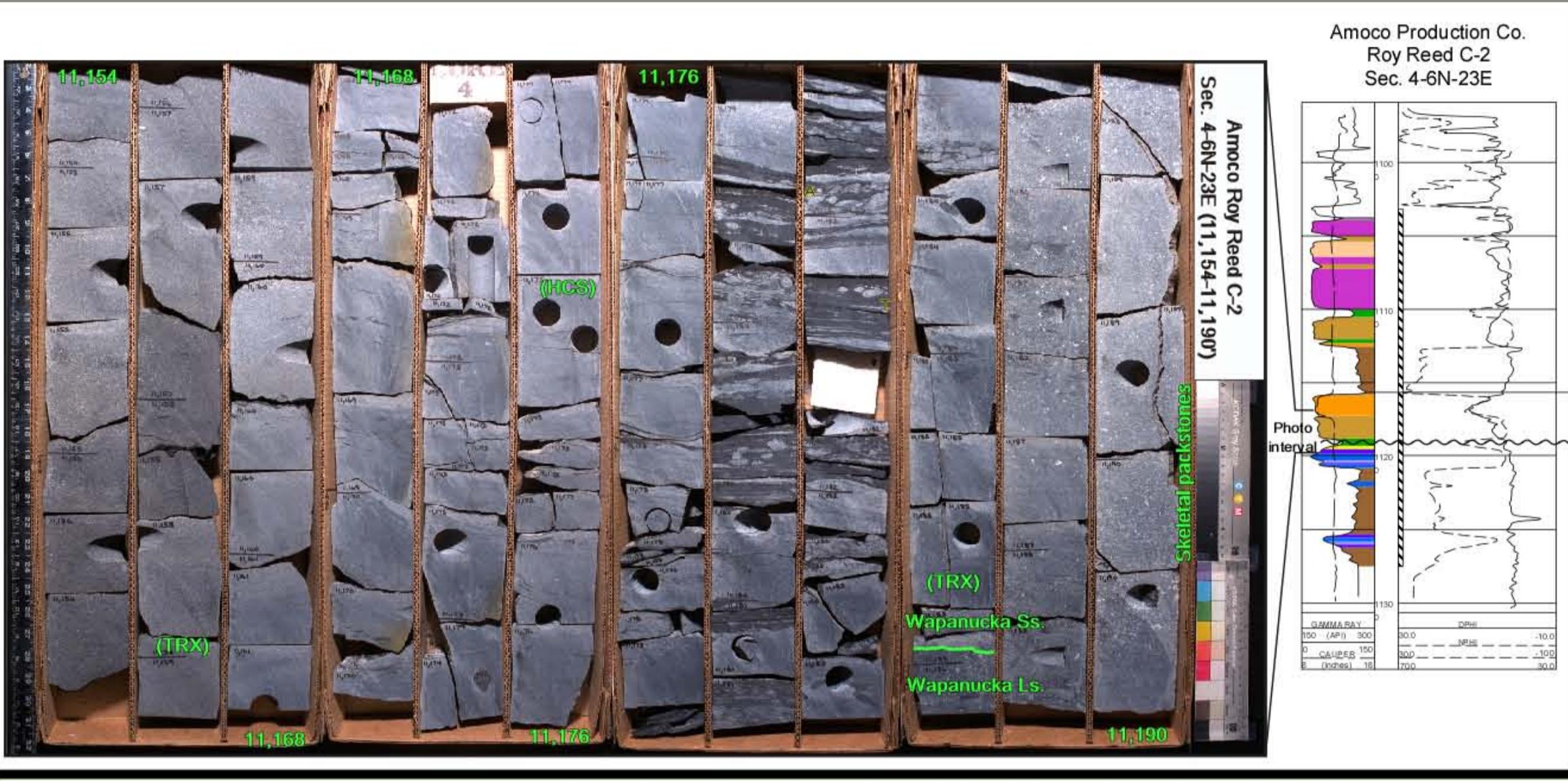


Sequence Boundary or Conformable Succession?

Placement of a sequence boundary within or at the top of the Wapanucka is based primarily on a lithologic change from skeletal carbonate grainstones to medium-to-coarse grained sandstone. Analysis of the sedimentary structures suggest that a significant facies offset (sequence boundary) may not be present. This succession could also be interpreted as laterally linked carbonate and siliciclastic shoreface and lagoonal depositional environment. The map below show the correlation of this interval across a two township area along the northern margin of the basin. What is striking is the network of channels and their dimensions (10-30 feet (3-10 m) deep and 2000-5000 ft (0.5-1.5 km) wide). In this instance the geometry of these channels would not suggest valley incision, but rather a network of tidal channels and coastal drainage pattern.

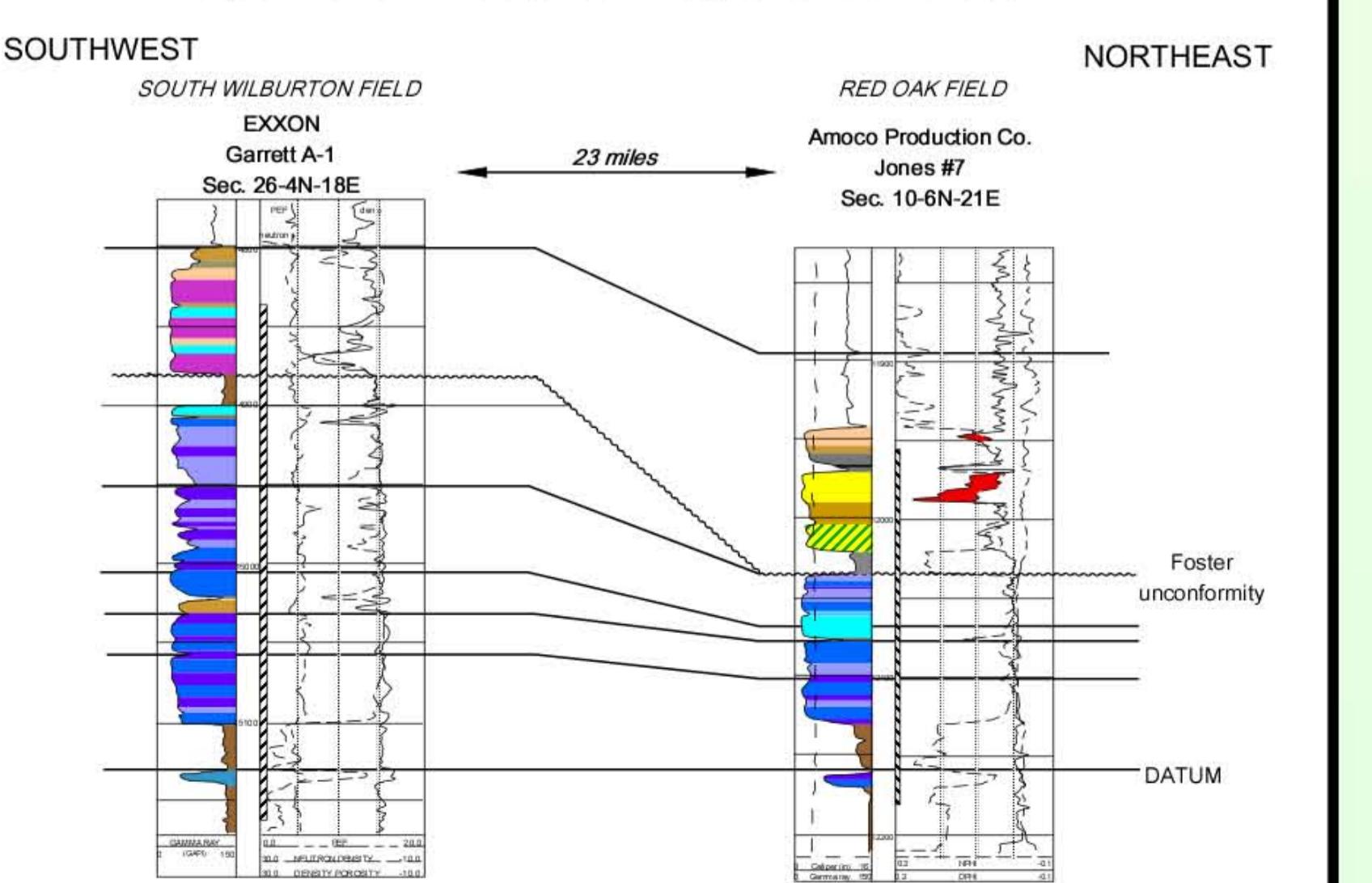


GIS Map Wapanucka Sandstone

Regional Correlation of the Wapanucka Limestone

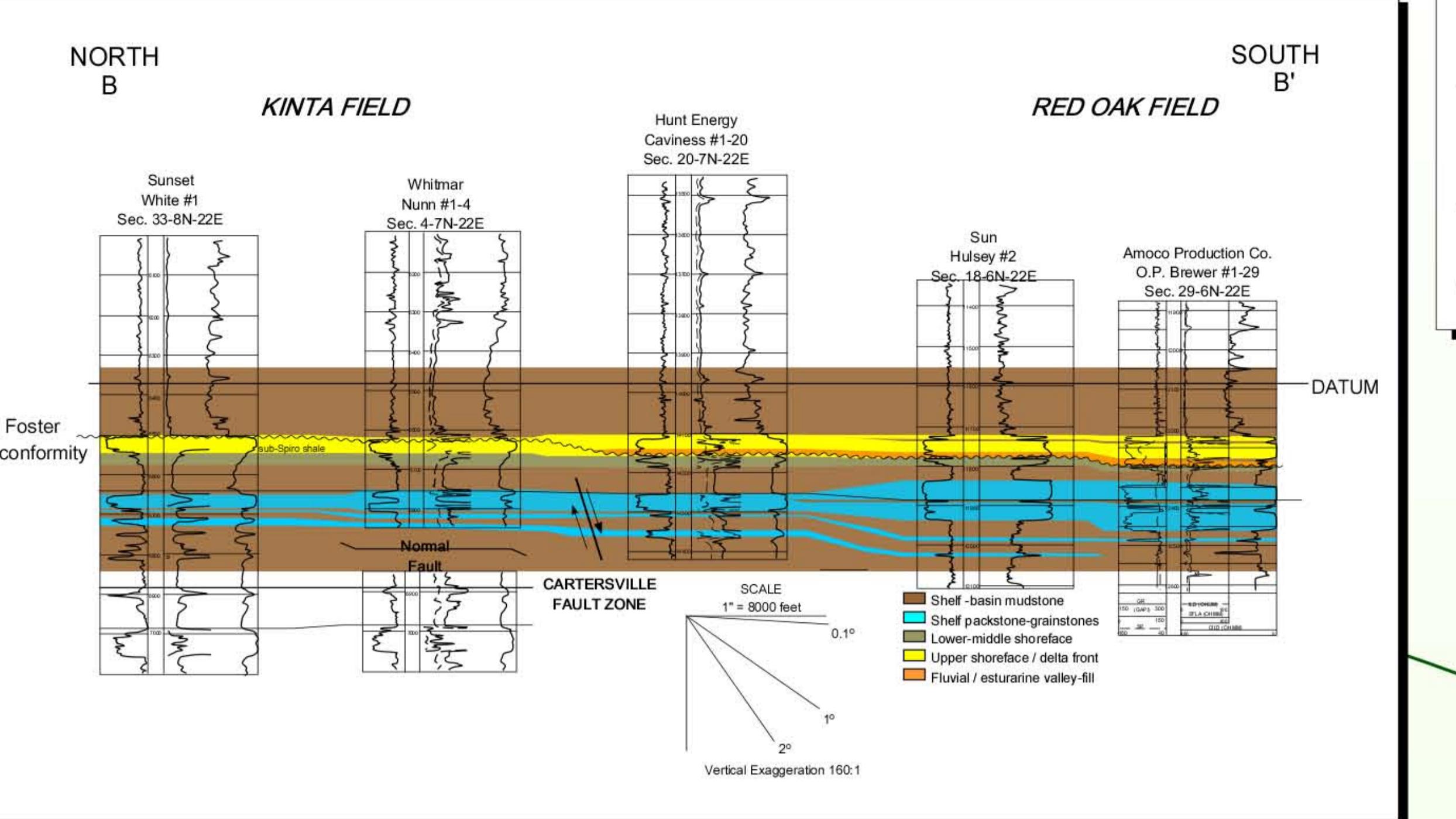
- Vertical aggradation of the Wapanucka in the western part of the basin and deepening upward stacking patterns observed from the Jones #7 core (right) in the upper part of the Wapanucka Limestone support an open marine interpretation of the sub-Spiro shale.
- Sub-Spiro shale is time-transgressive and coeval with the upper part of the Wapanucka Limestone. Shallowing-upward cycles (lower-to-middle shoreface) wells support open marine interpretation.
- Correlation of Wapanucka skeletal grainstones and siliciclastic sandstones. An apparent disconformable surface is present in the middle of the Wapanucka (Jones #7 well) overlain by sapropelic mudstones and skeletal grainstones.
- If a sequence boundary is present at the top of the Wapanucka Limestone, why would the stacking patterns indicate deepening rather than shallowing upward?

Wapanucka Limestone - Regional Correlation



Sub-Spiro Shoreface - A Key Observation

- Coarsening-upward profiles observed from the gamma ray curve correspond to lower-middle shoreface cycles identified in the sub-Spiro interval.
- Observed changes in cycle stacking patterns identify progradation of the sub-Spiro shoreface. Each cycle begins and ends with facies that represent a progressive decrease in water-depth and an increase in depositional energy created by waves and currents.
- Development of reservoir quality. Photomicrograph illustrates the preservation of primary porosity in the sub-Spiro sandstone. Dark residue in the interstitial pore space is pyrobitumen.

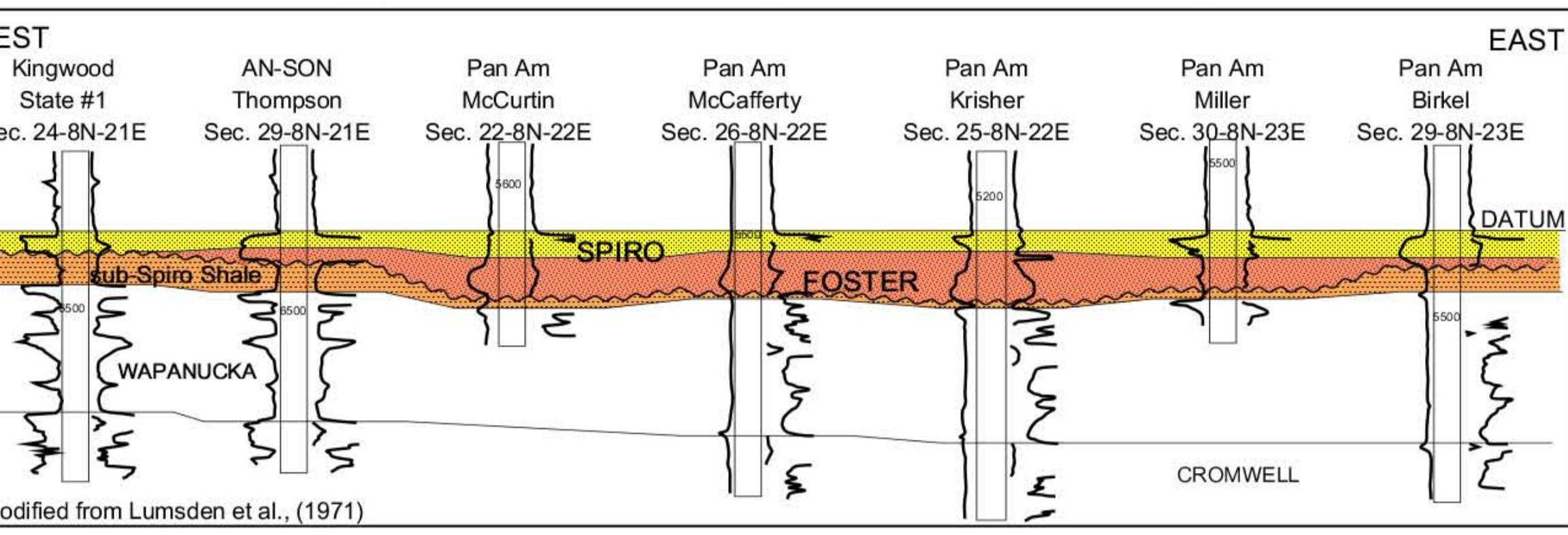


Correlation of Genetic Units - A Different Interpretation

- The deepening upward successions in the Wapanucka at Red Oak Field are correlative with the siliciclastic tidal facies observed from cores and well logs in the Kinta Field.
- The thickened Wapanucka section to the south is correlative with siliciclastic Wapanucka sandstone section to the north.
- Sub-Spiro lower-middle shoreface cycles are correlated with Spiro reservoirs in the Kinta Field that underlie the Foster channel sandstone.

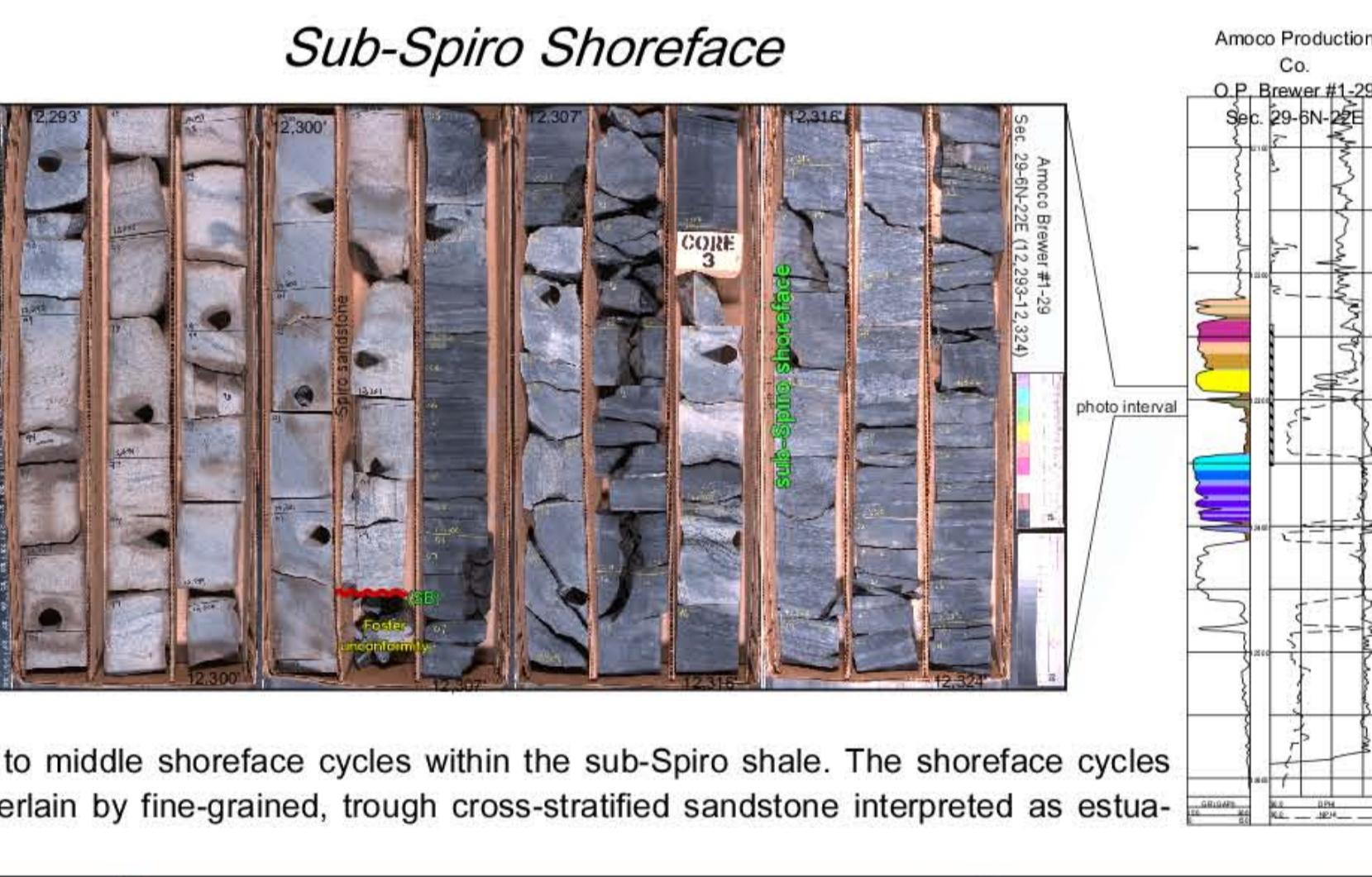
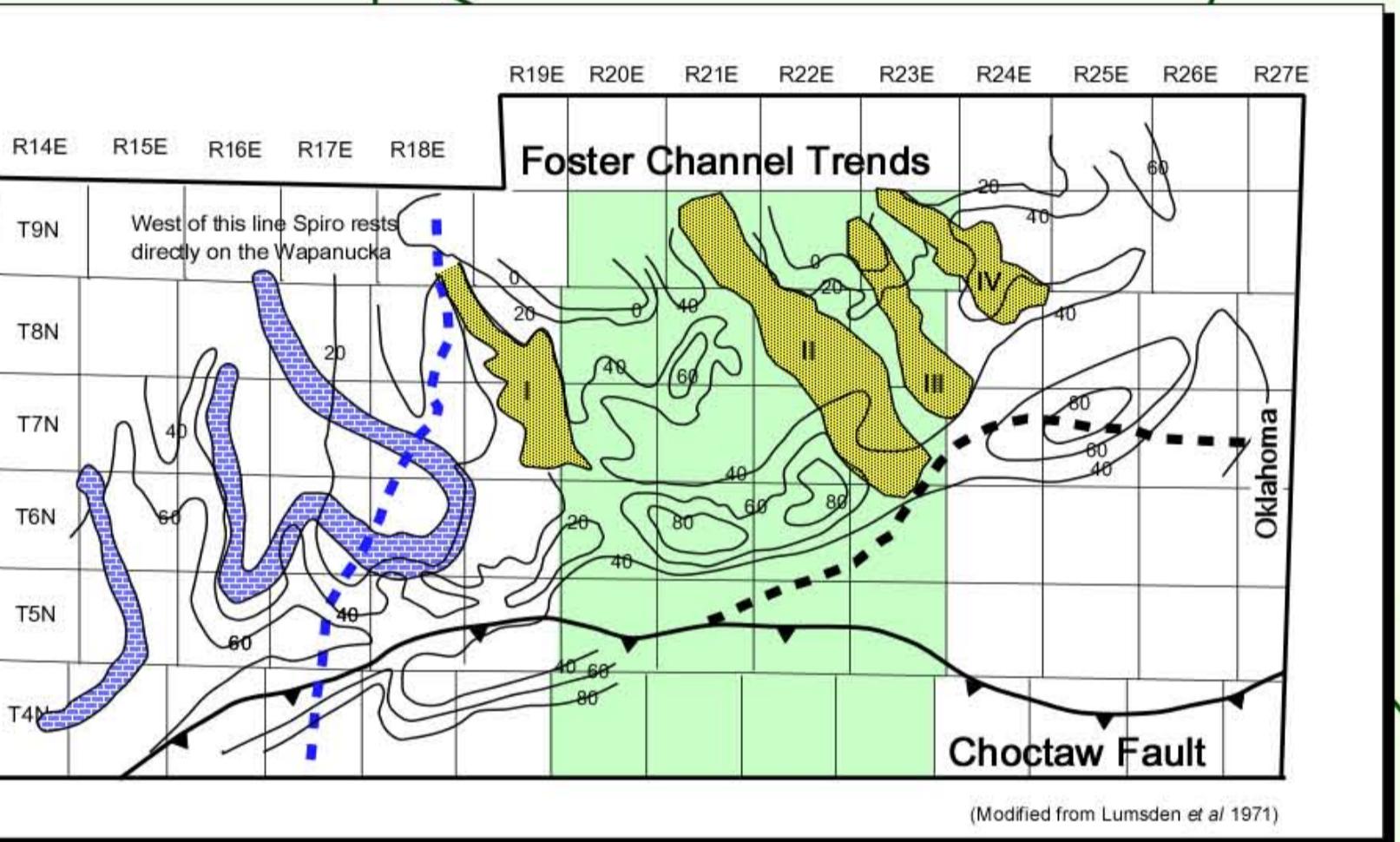
Foster Channel Sandstone - A Conformable Succession?

- Foster fluvial channel sandstones feed a coeval down dip shoreline (Lumsden et al, 1971). Down dip interpreted to be a conformable strandplain succession.
- Progradational shoreface linked with the updip fluvial facies tract not identified.
- The depositional environment of the sub-Spiro shale must be both coastal plain and marine.

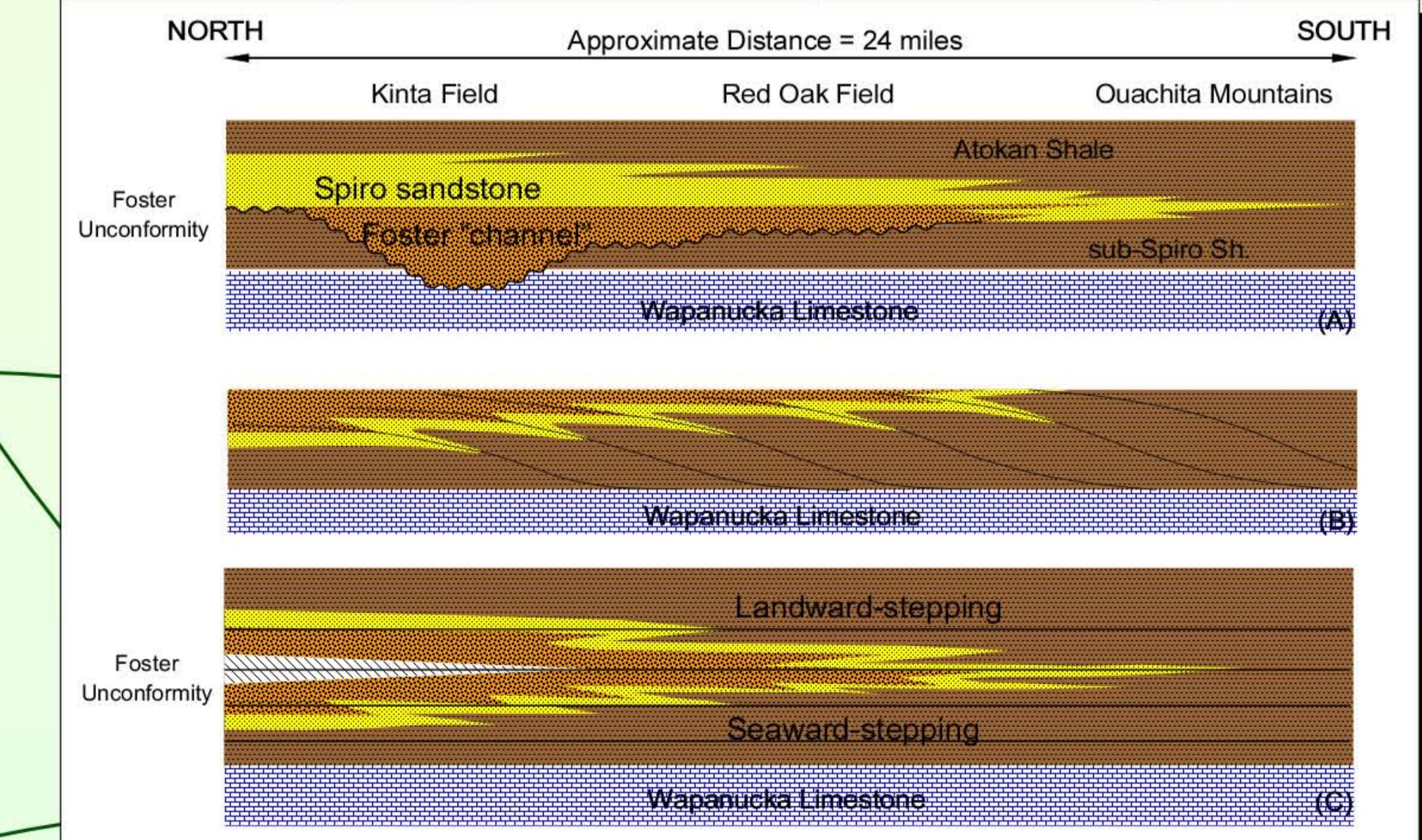
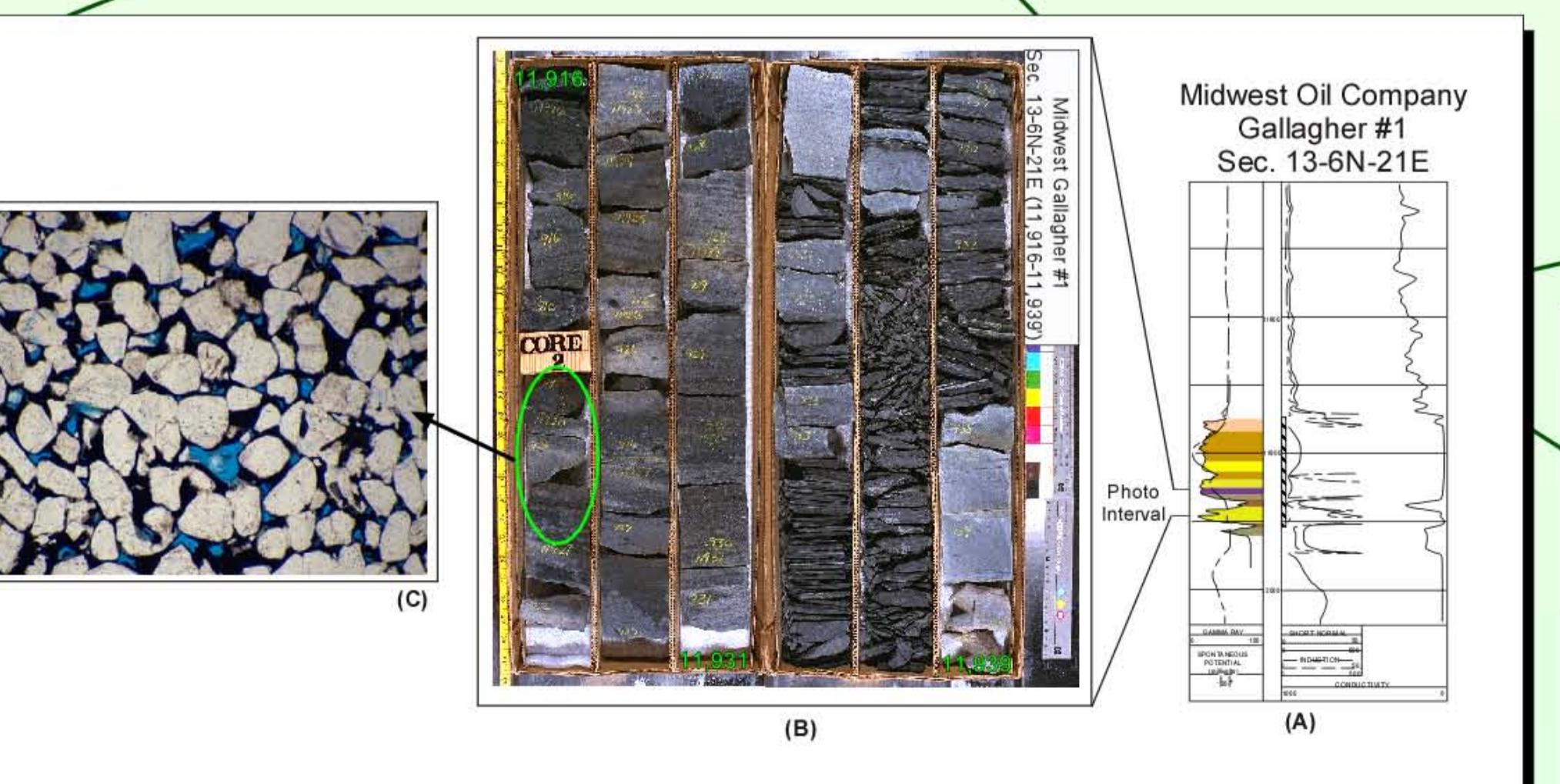


Spiro Paleogeography

Is the 'Spiro' sandstone that directly overlies the Wapanucka genetically related to the sub-Spiro shoreface, or Foster channel sandstones?



Sub-Spiro Shoreface



Time-Space Implications

- The erosion associated with the Foster channels is an autocyclic response to fluvial progradation across the shelf. Down dip shoreline is fed by the fluvial system. How did the shoreline arrived at its present location?
- Shoreface linked with Foster channels is shallow marine equivalent of the sub-Spiro shale identified from cores in the Red Oak and Kinta Field areas.
- The overlying Spiro sandstone caps the depositional cycle and in this scenario must onlap the genetically related Foster channel sandstone.