

A Regional Sequence Stratigraphic Framework for the Jackfork Group, Arkansas

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ABSTRACT

The ancient Ouachita Basin consists of 15,000 m (49,200 ft) of Carboniferous deep-water strata which covered an area of 246,592 km² (96,325 mi²) from Little Rock area in Arkansas to southeastern Oklahoma. The Pennsylvanian deepwater strata in the Ouachita Mountains have been studied for over 40 yr. It is one of the best examples demonstrating different types of turbidite sequences from updip channelized to downdip basinal systems. The Kirby sections in western Arkansas provide the opportunity to build a complete and continuous sequence stratigraphic framework for Early Pennsylvanian time in the ancient Ouachita Basin. The Kirby sections consist of 25 outcrops, including 12 roadcuts on Highway 27, and 13 sections in the Baumgartner Quarry. All the measurements and interpretations on the outcrops were integrated with previous work using modern concepts of deepwater turbidite geology, including (1) regional tectonic and sequence stratigraphic framework of the Stanley Group, Jackfork Group, and Johns Valley Shale in the Ouachita Basin, (2) deepwater outcrop characterization and correlation from the DeGray Lake section, Dierks section, and Big Rock Quarry, which is on the trend of the depositional fairway, and (3) chemical stratigraphic data from key shale layers that are considered as potential condensed sections for assisting correlation.

Twenty-five key shale samples from the Kirby, DeGray, and Dierks sections have been tested using inductively coupled plasma and mass spectrometry (ICP-MS) and x-ray fluorescence (XRF). Rare earth and trace elements results are compared with known tectonic data to further pinpoint the tectonic environment of the Ouachita Basin during early Pennsylvanian time, which is dominantly a continental arc setting. Results of sequence and chemostratigraphic analysis also indicate that the entire Kirby sections consist of at least three 3rd-order sequences from the bottom of the Jackfork Group to the middle of the Johns Valley Group, and over ten 4th-order sequences caused by a combined effect from tectonic uplift, eustatic sea-level change, mixed sediment provenance, and shifting of depositional fairways when the Ouachita Basin was shifting from a passive margin to a remnant ocean basin.