

Mudrock Geochemistry of Atoka and Stanley Formations: Implications for Ouachita Trough Provenance Evolution

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Mudrock geochemistry for deepwater Atoka Formation (this study) and for Stanley Formation (from Totten and Blatt, 1993, and Totten et al., 2000) shows similarities and differences in provenance for fine-grain detritus to the Ouachita Trough of Oklahoma. Mudrocks from both have a high chemical index of alteration (CIA) and wide range of index of chemical variability (ICV). Intense chemical weather is indicated by Atoka CIA is ~85, and Stanley CIA is ~75. ICV values for both are 0.5+0.2; given this wide ICV range at these CIA values, provenance could be from felsic, as well as mature cratonic interior, to mafic igneous rocks. However, both indices are calculated from potentially mobile major elements. Provenance diagnostic trace elements and rare earth elements (REE) provide insight to provenance contributors. Petrogenetic ratios involving Zr and Th are considered suspect due to the high CIA values. Other trace elements suggest a mixed felsic and mafic provenance. Enrichment factors based on North American Shale Composite (NASC) show elevated enrichment for Cr, Ni, Ti, Sc, V and REE in Atoka compared to Stanley mudrocks, suggesting that Atoka provenance included mafic island arc volcanics and even mid-ocean ridge basalts. Chondrite-normalized REE for both mudrock sets are enriched in REE with no Eu anomaly. NASC-normalized REE are markedly enriched in REE with positive Eu anomaly for Atoka and near normal to slightly enriched REE for Stanley mudrocks. Taken together, both Atoka and Stanley provenance included felsic (+cratonic interior) and mafic sources, but Atoka mudrocks express a relatively stronger mafic provenance.