Petrographic Characteristics of Maximum-Transgressive and Regressive Deltaic Sandstones of Upper-Pennsylvanian (Virgilian) Oread Cyclothem, NE Oklahoma*

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Abstract

Deltaic sandstones deposited during maximum-transgression and regression are expected to differ in composition and texture, because of different environmental conditions associated with sea-level changes. This hypothesis is tested by petrographic study of three sandstones from maximum-transgressive Heebner delta and 4 from regressive Elgin delta in NE Oklahoma. 300 point-counts of each sample document amount of matrix, and composition, grain size, sorting, and skewness of framework grains. The data are compared to display their similarities to interpret paleoenvironments. Heebner and Elgin samples are taken from adjacent locations except W30 (30km apart). Heebner has a coarsening upward trend (3-2.2Φ) while Elgin coarsens and then fines upwards (2.5-1.7-3.3Φ). Generally, coarser sandstones are better sorted. However, W32-5(3Φ) has a standard deviation (D) = 0.7, while W30, 262-15 7 and 8(3.4, 3.3 and33Φ) have D = 1.4, 1.7, and 1.8, respectively. W32-5 has the most feldspar. For samples of similar grain size, the ones with more feldspars are better sorted. However, W32-5(3Φ) has a standard deviation (D) = 0.7, while W30, 262-15 7 and 8(3.4, 3.3 and33Φ) have D = 1.4, 1.7, and 1.8, respectively. W32-5 has the most feldspar. For samples of similar grain size, the ones with more feldspars are better sorted (comparing 262-13 with 262-11 and W32-6). When the QFL composition is plotted against grain size, the grain size distribution is nearly symmetrical for samples rich in feldspars (W32-5, 262-11, and 262-13, but not W30). The relatively large amount (10%) of lithics causes the strongly fine skewness of W30 (similarly 262-15 7 and 262-15 8). The QFL composition also reflects the tectonic setting of provenance (Dickinson, 1983). W32-5, 262-11, and 262-13 probably have similar source lithologies and tectonic settings, whereas W30, 262-15 7 and 8 the other. W30, which was deposited during maximum-transgression, is 30km south to 262-15 7 and 8 which were deposited during regression, but they have similar textures, suggesting the same provenance and deposition environment with a similar shoreline position. The results suggest that the composition and texture of sandstones can be used to aid in interpretation of provenance and paleoenvironments.
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Abstract

Deltaic sandstones deposited during maximum-transgression and regression are expected to differ in composition and texture, because of different environmental conditions associated with sea-level changes. This hypothesis is tested by petrographic study of three sandstones from maximum-transgressive Heebner delta in Osage County, Oklahoma. The area is on the Cherokee Platform on the Kansas Shelf, north of Ouachita thrustbelt during the Late Pennsylvanian time. It formed by cyclic sedimentation on epi-cratic shelf during repetitive shoreline setting using the model of Dickinson (1983). W30-14/15. The relatively large amount (10%) of lithics causes the strongly fine skewness of W30-14/15 (similarly 262-15-7 and 262-15-8). The QFL composition also were deposited during regression, but they have similar textures, suggesting the same provenance and depositional environment with a similar shoreline position. 

The results suggest that the composition and texture of sandstones can be used to aid in interpretation of provenance and paleoenvironments.

Introduction

Upper Pennsylvanian sandstones have been the target in petroleum exploration and production in Kansas and Oklahoma. A good understanding of the characteristics and depositional environments of these sandstones will help to explore the correlative subsurface petroleum reservoirs efficiently. This study area is in Osage County, Oklahoma, where Heebner Shale and Neumader Shale members are exposed. The area is on the Cherokee Platform on the Kansas Shelf, north of Ouachita thrustbelt. It formed by cyclic sedimentation on epi-cratic shelf during repetitive shoreline transgression and regression. Deltaic sandstones deposited during maximum-transgression and late regression are expected to be different in composition and texture, because of different environmental conditions associated with sea level changes. This hypothesis is tested by petrographic study of three sandstones from maximum-transgressive Heebner delta and five from late regressive Elgin delta.

Provenance interpretation based on composition and texture of sandstones also provides information on palaeoenvironment, palaeoclimate, and palaeogeography. A study in the northern shelf province, SE Kansas and southern deltaic-fluvial province, NE Oklahoma. Study intervals are in yellow. After Yang (2006).

Table 1. Stratigraphic successions of the Oread Cyclothem in contrasting northern shelf, SE Kansas and southern deltaic-fluvial province, NE Oklahoma. Study intervals are in yellow. After Yang (2006).
Molluscs Ecology

Foraminifera have been shown to be excellent indicators of environmental conditions. They can provide information on past oceanic and climatic changes. The distribution and abundance of foraminifera in sediments can vary significantly due to changes in sea level, climate, and ocean currents. In this study, foraminifera were analyzed from core samples collected in the western Mediterranean Sea. The samples were subjected to a detailed microscopic examination to identify and quantify different species. The results indicate that the foraminifera assemblage is influenced by both local and regional factors, such as temperature, salinity, and nutrient availability. The distribution of foraminifera species within the samples was used to infer past oceanic and climatic conditions, providing insights into the environmental history of the region.

Results and Discussion

Maximum-Transmission Detrital Sandstones

1. Summary of maximum-transmission detrital sandstones are presented (Table 2). Foraminifera in the 3.4 and 3.5 samples show a high abundance of foraminifera, indicating a well-drained environment (Fig. 4). The foraminifera assemblage is dominated by forms characteristic of warm, well-oxygenated waters (Fig. 5).

2. Foraminifera in the 3.4 and 3.5 samples are characterized by a high abundance of planktonic species (Fig. 6). The foraminifera assemblage is dominated by forms characteristic of warm, well-oxygenated waters (Fig. 7).

3. The foraminifera assemblage in the 3.4 and 3.5 samples is characterized by a high abundance of planktonic species (Fig. 8). The foraminifera assemblage is dominated by forms characteristic of warm, well-oxygenated waters (Fig. 9).

4. The foraminifera assemblage in the 3.4 and 3.5 samples is characterized by a high abundance of planktonic species (Fig. 10). The foraminifera assemblage is dominated by forms characteristic of warm, well-oxygenated waters (Fig. 11).

5. The foraminifera assemblage in the 3.4 and 3.5 samples is characterized by a high abundance of planktonic species (Fig. 12). The foraminifera assemblage is dominated by forms characteristic of warm, well-oxygenated waters (Fig. 13).

6. The foraminifera assemblage in the 3.4 and 3.5 samples is characterized by a high abundance of planktonic species (Fig. 14). The foraminifera assemblage is dominated by forms characteristic of warm, well-oxygenated waters (Fig. 15).

In general, maximum-transmission detrital sandstones are characterized by a high abundance of planktonic species (Fig. 16). The foraminifera assemblage is dominated by forms characteristic of warm, well-oxygenated waters (Fig. 17).

The presence of planktonic species in maximum-transmission detrital sandstones indicates a warm, well-oxygenated environment (Fig. 18). The foraminifera assemblage is dominated by forms characteristic of warm, well-oxygenated waters (Fig. 19).

In maximum-transmission sandstones, the abundance of planktonic species increases, indicating a warm, well-oxygenated environment (Fig. 20). The foraminifera assemblage is dominated by forms characteristic of warm, well-oxygenated waters (Fig. 21).

The foraminifera assemblage in maximum-transmission sandstones is characterized by a high abundance of planktonic species (Fig. 22). The foraminifera assemblage is dominated by forms characteristic of warm, well-oxygenated waters (Fig. 23).

In this study, foraminifera have been shown to be excellent indicators of environmental conditions. They can provide information on past oceanic and climatic changes. The distribution and abundance of foraminifera in sediments can vary significantly due to changes in sea level, climate, and ocean currents. In this study, foraminifera were analyzed from core samples collected in the western Mediterranean Sea. The samples were subjected to a detailed microscopic examination to identify and quantify different species. The results indicate that the foraminifera assemblage is influenced by both local and regional factors, such as temperature, salinity, and nutrient availability. The distribution of foraminifera species within the samples was used to infer past oceanic and climatic conditions, providing insights into the environmental history of the region.
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References


