ABSTRACT: The Muddy Sandstone in the Wind River basin, Wyoming, represents a series of deltaic and interdeltaic shoreline environments. Specific inferred environments are delta constructional phase, delta destructional phase, tidal flat, estuarine channel, barrier bar, beach, and lagoon. Interpretation of the depositional environments is based on the following criteria: (1) vertical and lateral trend in sedimentary structures, (2) trace fossils, (3) vertical and lateral variation in lithofacies, (4) paleocurrent analysis, and (5) composition and texture.

In the northern part of the Wind River basin, lower delta plain environments consisted of delta constructional and destructional phases, barrier bar, and spit. Greater alluviation in the north gave rise to deltaic sedimentation against destructive marine processes. These deltaic rocks contain features characteristic of tidal flat sedimentation and differ from the deltaic facies that form in areas of lower tidal ranges. Delta abandonment resulted in reworking of the upper Muddy marine sediments, and a thin, well-sorted sandy facies was formed over the deltaic sediments.

Shorezone environments were confined to the southwestern parts of the Wind River basin. Well-sorted, coarse-grained, quartzose sand accumulated in bar, lagoon, and beach environments to the southeast, whereas predominantly clay and silt were deposited in tidal flat and estuarine environments to the west.

Well-defined, bimodal current directions observed in the Muddy Sandstone can be attributed to a tidal origin. Interpretation of current directional data suggests a combination of seaward flow and littoral drift resulting from a fluvo-tidal system in the northeastern region, and a predominantly tidal current system nearly normal to the shoreline in the southern part of the study area. The southeastern region is characterized by current directions predominantly parallel to the shore.

Sedimentation of the Muddy Sandstone and underlying Thermopolis Shale represents simultaneous sedimentation and progradation during a stillstand of the Thermopolis Sea. The shoreline trend was easterly in the northern part and southeasterly in the southern part of the basin. Mud was the principal bottom sediment; progradation of sand over mud occurred in nearshore areas and lenses and tongues of sand developed in mud seaward from the shoreline area.

INTRODUCTION

The Lower Cretaceous Muddy Sandstone is a well-known formation in the Western Interior of the United States due to its petroliferous nature. Exploration for oil and gas in the Wind River basin has been primarily limited to drilling anticlinal structures. Many of the known structures have been explored; therefore, future exploration in the region will be a search for stratigraphic traps or for a combination of stratigraphic and structural traps. In order to locate stratigraphic traps, a complete understanding of depositional environments and lateral facies changes is essential.

The Muddy Sandstone in the Wind River basin is a laterally persistent unit of fine- to medium-grained sandstone interbedded with varied amounts of gray to black shale and siltstone. The thickness is as much as 30 m in places along the west margin of the Wind River basin, but locally the sandstone thins and grades almost completely into shale and siltstone. In this area, the Muddy Sandstone overlies the Thermopolis Shale and underlies the Mowry Formation (Fig. 1).