HYDROCARBON ACCUMULATIONS IN THE "D" SAND ADAMS AND ARAPAHOE COUNTIES, COLORADO

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ABSTRACT

The Lower Cretaceous "D" sand in western Adams and Arapahoe Counties, Colorado, contains significant hydrocarbon reserves in stratigraphically trapped reservoirs. Reservoirs are developed in marine bar-type sandstones and in deltaic distributary channel sandstones. Trapping conditions include classical stratigraphic traps consisting of up-dip pinchout of sandstone, and more complex traps such as interchannel point bar porosity-permeability pinchout traps. Recognition of the environment of deposition of individual sand bodies combined with a practical mapping technique utilizing log shape/structure maps should lead to more discoveries in this area.

INTRODUCTION

This paper reviews oil and gas accumulations in the "D" sand (Lower Cretaceous) in the Adams and Arapahoe County area in the Colorado portion of the Denver basin (Fig. 1). Emphasis is on accumulations discovered since 1969. Since 1969, rejuvenation of drilling activity in this portion of the Denver basin has resulted in several new field discoveries and extensions of several old fields.

Traps in the "D" sand in this area are stratigraphic and consist of marine bar sands that pinch out up-dip into impermeable sands or marine shales, channels crossing very low relief structural noses, and channels with complex point bar sequences which allow interchannel trapping without benefit of structure (Martin, 1965, p. 1922-1923). Hydrocarbons may have been generated in adjacent source rock shales and did not require long migration routes to fill available "D" sand traps.

"D" SAND STRATIGRAPHY

The "D" sand in western Adams and Arapahoe Counties, Colorado, can generally be divided into two zones, an upper "D_1" unit and a lower "D_2" unit (Fig. 2).

The "D_1" sand is considered to be a marine sand, probably a transgressive sandstone representing the earliest phase of the Graneros transgression. The contact between the "D_1" sand and the overlying Graneros Shale is conformable throughout the basin. The "D_1" sand is characterized by bar-type sand developments as recognized by mechanical log shape and physical characteristics such as an upward increase in grain size, greater porosity near the top (Fig. 3), and, where the "D_2" is not developed, a gradational lower contact from shale to silt to sand. "D_1" sand bars, where well developed, have moderate to good porosity (10 to 18%) and moderate to good permeability (50 to 500 md). Sands are generally well sorted and are subangular to well rounded. Regional mapping of the "D_1" sand in Washington, Weld, Adams, Arapahoe and Elbert Counties, Colorado, indicates the bars are oriented northwest-southeast to north-south. A length-to-width ratio of 2.5 to 1 has been observed.

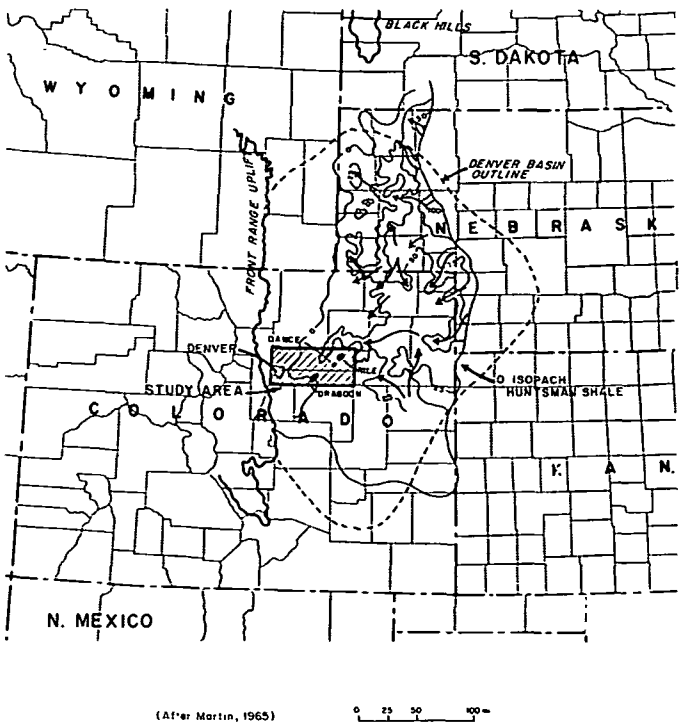

Fig. 1—Index map of the Denver basin with "D" Sandstone Isolith.

The "D_2" sand is a more complex unit than the overlying "D_1" sand. Representing a more regressive phase of deposition, it is characterized by a suite of depositional environments ranging from distributary channels to spillover bars to marine bars. All combinations may occur. The same log and physical parameters used to identify "D_1" bars can be used to identify the "D_2" bars. "D_2" channels have classical log shapes and physical criteria, i.e., downward increase in grain size, greater porosity near the base, and unconformable cut-and-fill basal contacts (Fig. 4). The channel sands exhibit poorer sorting and rounding

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