

Michael A. Raines, Kinder Morgan CO₂ Co., L.P.
500 North Loraine, Suite 1175 Midland, Texas 79701

Interpretations on a Pennsylvanian Reef

The 2.8 Billion Barrel (Original Oil in Place) SACROC Unit is located in Scurry County, Texas and produces from the Pennsylvanian-aged Cisco and Canyon Formations of the Kelly-Snyder and Diamond M Fields. This Unit has had a colorful history, with discovery in 1948, an exceeded bubble point in 1952, implementation of crestal water-flood efforts in 1954, and early tertiary efforts in 1972. Since that time, local experience and industry practices have contributed to CO₂ knowledge. Today, Kinder Morgan CO₂ Co., L.P. (KMCO₂) is CO₂ flooding an area in the central portion of the Unit (using new techniques and philosophies) with great success. Unit production is now at an eight-year high, averaging 11,000 BOPD.

Because tertiary recovery efforts are very expensive, they require a great deal of reservoir understanding to reduce risk and increase efficiency. So, KMCO₂ has initiated a dual-pronged approach to the continued development of SACROC Unit, with flooding efforts currently focused on "less risky" areas, and more intense geologic study focused on understanding the more complex, higher risk, and greater potential areas.

The SACROC reservoir is extremely complex and data is sometimes scarce, misleading, low quality, or ambiguous. Few modern logs exist, and unique situations can cause confusion about log responses. Correlations are difficult in certain areas due to mound buildups, erosional contacts, and local depositional geometry. Strange fluid flow responses occur in certain simple-looking areas. Geologic investigations are focusing on understanding the significance of these reservoir characteristics and incorporating them into development plans.

That said, the Unit can still be divided into northern, central, and south-western regions for general comparisons. A thick, north-south trending platform, with karst features that increase in intensity to the north and higher in the section, dominates the northern area. The platform can be further subdivided into Cisco and Canyon portions. A series of laterally continuous flow units dominates the Canyon. The units are broad (~2 miles wide) low in the section and thin upward (< ¼ mile wide at the top). The Cisco (an amalgamation of debris flows, in-place bioherm mounds, original deposition and diagenetic features) sits above and on the flanks of the Canyon. The central region of SACROC is a broad, gently arching plain (mostly Canyon), broken by steep-sided pinnacles, gentler mounds, intermittent sinuous lows, and localized depressions. The southwestern area is the most structurally complex region of the Unit, exhibiting a complex series of faults and channels that result in small, isolated compartments.

Tertiary flooding efforts by KMCO₂ and previous operators have arrested and reversed the production decline on the 50-year old SACROC Unit. This highly complex reservoir is now being analyzed on a flow unit scale for continued enhanced oil recovery efforts through modern approaches to CO₂ flooding.