“ Regional Sequence Stratigraphy and Depositional Environments of Lower Pennsylvanian Reservoir Sandstones, Southwestern Kansas “

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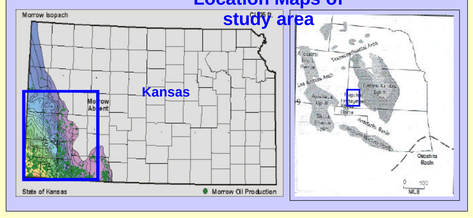
Abstract

Lower Pennsylvanian Morrow sandstone units in southwestern Kansas have produced hydrocarbons for more than six decades, but remain an attractive target for the hydrocarbon exploration and development. The Morrow sandstone was deposited above a pre-Pennsylvanian regional unconformity in the Hugoton embayment a northeast shelf-like extension of the Anadarko Basin. Numerous depositional models have been proposed for the Lower Pennsylvanian siliciclastic succession, and stratigraphic nomenclature can be confusing. Based on wireline logs and cores, a regional sequence-stratigraphic framework has been established for the Morrow of southwest Kansas. Up to six depositional sequences associated with distinct incised valleys are recognized. The valleys are oriented in a north-south direction. Individual incised valleys range from 10 to 70 km in width and have been traced southward for over 200 km. The lower three incised valley-fill complexes (1, 2 and 3) thicken from 6 meters southward to over 30 m. The younger incised valley-fill complexes (4-6) are each less than 10 m thick. Depositional systems composed of fluvial, estuarine and shallow marine lithofacies fill each incised valley. The observed eastward temporal migration of the lower incised valley complexes reflected subtle syndepositional regional tectonic movements in southwest Kansas and adjoining Colorado.

In addition to lithofacies and diagenetic controls, reservoir quality is strongly influenced by location within a particular incised valley fill complex. An improved understanding of depositional environments and chronostratigraphic framework of the “Morrow” sandstone can help enhanced-oil recovery projects and give new insights for continued hydrocarbon exploration and development drilling in the area.

Location Maps of study area



Morrow Facies

Fluvial

(Kendricks23-1, 5354'-5359.5')

Lightgray,veryfinetocoarsesandstone,wellto moderatesorted, laminated to low- angle cross bedded; with coallaminationsorcoalfragments.

Paleosol

(Longwood Gas Unit2,4835'- 4838.5')

Reddish to light gray shale, blocky,withpeds and slickensides.

Estuarine

Sandstone (Upper Estuary)

(BreedingGas UnitF-1,5257.7'-5264.7')

(Kendricks23-1, 5441'-5444.6')

Lightgray,finesandstone, oftenglauconitic, slighlty to non calcareous, well to moderate sorted; mud drapes,flaserandwavybedding; occasionally starved ripples.Somehorizontal burrowing.

Mud (Central Basin)

(GraceKilgore1,5519'-5526')

Darkgraytoblackshale, subhorizontal parallel laminated, generally highly carbonaceous,non calcareous.

Sandstone (Lower Estuary)

Lightgray,finetocoarsesandstone, occasional conglomeratic, oftenglauconitic,slightly tonon calcareous, moderatesorted; with mud drapes, flaser bedding, wavy bedding and some starved ripples. Horizontalburrowing is present. Rare fossilfragmentsnear top.

Open Marine Silisiclastic

Nearshore (Upper Shoreface)

(GraceKilgore1,5492'-5504')

Lightgray,coarseto mediumsandstone, glauconitic,calcareous,fossiliferous, moderate to poorly sorted, withhigh-angle planar parallel cross bedsandsubhorizontal parallel laminations.

Nearshore (Lower Shoreface)

(NellA-1,6050'-6053')

Lightgray,finetomediumsandstone, glauconitic, calcareous,fossiliferous, moderate to wellsorted; common low-anglecrossbeds.Somevertical burrows.

Offshore Transition

(Kniffen A-2, 6254'-6259')

Lightgray,finetovery fine sandstone, calcareous,glauconitic,interlaminated with dark grayshale,highlyhorizontaland vertically burrowed.

Shelf Shale

(BreedingGas UnitF-1,5171'- 5178')

(Gaskill2-A, 5976'- 5986')

Darkgray, generally calcareousshale, subhorizontal parallellaminae;occasionally interlaminated with light gray,veryfine, calcareous,glauconitic sandstone with wave ripples.

Open Marine Carbonate

Open Marine Limestone (Subtidal)

(Longwood Gas Unit2,4844.5'-4852')

Llight gray orbrown, crinoidal packstone to wackestone with fossil fragments (brachiopods, bivalves, bryozoansand rare corals).

(Longwood Gas Unit2,4852.3'-4856')

Llight gray orbrown, crinoidal wackestone to packstone with whole fossilsandfossil fragments (brachiopods,bivalves, bryozoans and rare corals).l

Lower Subtidal - Offshore Transition

(Longwood Gas Unit2,4865'-4869')

Lightgraymudlimestonetocrinoidal wackestone, interlaminated-to-very thinly interbeddedwithblackshale.Soft sedimentdeformation, whole fossils and articulated crinoid fragments.

http://www.Kgs.Ku.edu/PRS/publication/2003/ofr2003-34/index.html