

FACIES TRACT MAPPING TECHNIQUE, A SEQUENCE STRATIGRAPHIC TOOL: CASE STUDY OF LOWSTAND CARPER SANDSTONE PLAY, LOWER CARBONIFEROUS OF EASTERN ILLINOIS BASIN, NORTH AMERICA

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Use of sequence stratigraphy as a predictive tool has minimized geologic uncertainties in exploration by providing for reliable correlation and prediction of source, reservoir, seal, and structural/stratigraphic elements of petroleum systems, hydrocarbon plays and prospects. A case study of the hydrocarbon potential of the Lower Carboniferous Carper sandstone deposited by turbidity currents in the Illinois Basin of North America (an interior cratonic sag basin) illustrates the application of sequence stratigraphy and geologic riskbased play evaluation to provide realistic estimates of the reservoir continuity, thickness, seal integrity, and entrapment.

Cores, cuttings, and well logs from 120 closely spaced wells were used to hierarchically bundle depositional facies and map facies tracts. Three distinct paleogeographic "elements" (parasequence-scale depositional systems) that pinch out up-dip to the east along a narrow shelf margin are recognized. These systems consist of proximal toe-of-slope prograding/aggrading depositional ramp, distal ramp sand lobes/sheets and channel-levee banks, and distal lobes/ basin floor fans. The systems evolved from sandrich to mud-dominant through time. Sequence stratigraphic analysis also allowed for correlating and mapping transgressive Carper sandstones in the system. The reconstructed stratigraphic architecture helped predict and map a four-way pinch-out. The presence of essential petroleum system elements (reservoir, seal, and entrapment) along with the timing of hydrocarbon generation, migration, charge, and entrapment make this play viable. Using the exploration risk checklist, each element was assigned a value (Unfavorable= 0.1-0.3, Questionable = 0.3 -0.5, Neutral = 0.5, Encouraging = 0.5-0.7, Favorable= 0.7-0.9). Several prospects were analyzed and field sizes estimated using analogue-based lognormal probabilistic approach. The results show that the Carper play which remains untested in the study area offers promising exploration opportunities to small independent operators.