

Depositional Facies and Petrophysical Properties of the Pennsylvanian Cottage Grove Sandstone Member (Osage–Layton Sand), Chanute Formation—East Newkirk Field, Cherokee Platform, Oklahoma

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Core and e-log interpretations indicate that the Cottage Grove Sandstone Member (Osage–Layton Sand) of the Pennsylvanian Chanute Shale Formation, at least in this geographic setting, consists primarily of a heterogeneous (120-ft [37-m])-thick succession of delta-front deposits. The delta-front deposits can be subdivided into a proximal delta-front facies (distributary mouth-bar subfacies) and a distal delta-front facies. The delta-front facies grades seaward into prodelta deposits and is capped by a marine-transgressive black shale facies.

Compositionally, the sandstones are primarily lithic subarkoses. Quartz is the dominant framework grain with lesser amounts of feldspars, rock fragments, and clays. Clay content consists primarily of illite + smectite and ranges from 1% to 39%, averaging 18%, and is correlated inversely with grain size.

The sandstone succession shows significant degrees of internal heterogeneity, including carbonaceous-lined laminae, comminuted plant material, shaly coal and coal spars, clay rip-up clasts, shale laminae and interbeds, and secondarily matrix-clay content and locally cemented zones.

Measured core porosities range from 2% to 20%, averaging 16%. Porosity is limited primarily by compaction of ductile rock fragments and muddy matrix. Measured core permeabilities range from 0.01 to 97 md, averaging 15.3 md. Illite + smectite is the main permeability-reducing component and is followed in decreasing order of importance by compaction, ferroan dolomite, and quartz overgrowths. Core porosities and permeabilities are consistently higher and more uniform in the proximal delta-front facies (distributary mouthbar subfacies) and lowest in the distal delta-front, prodelta, and marine transgressive shale facies.