Depositional cycles of Permo-Pennsylvanian (Virgilian and Wolfcampian) Cisco Group strata of the Eastern Shelf of the Permian Basin are dominantly transgressive limestones interstratified with highstand fluvial-deltaic and lowstand incised-valley-fill sandstones and mudrocks. Alternating, thickened transgressive shelf-edge limestone systems and lowstand shelf-edge deltaic deposits, equivalent to valley-fill systems, were deposited along the margin of the deepening basin. This study focuses on the lower Wolfcampian Tannehill sandstone as an example of the areal and shelf-to-basin stratigraphic expression of one of these valley-fill/lowstand delta systems.

The Tannehill sandstone occurs in two areal configurations in Nolan, Taylor, Coke, and Runnels counties: (1) narrow, slightly curvilinear belts that extend southwestward and east-west across this study area and (2) local, digitate depositional trends. The first configuration represents lowstand valley-fill systems that locally incise the Saddle Creek Limestone. These facies are 20–50 ft (6–15 m) thick, have blocky to upward fining wireline-log responses characterized by consistently low resistivity values, high spontaneous potential (SP), and low gamma ray (GR) values, and are restricted to on-shelf areas. Down dip equivalents of these sandstones with digitate areal configurations are marked by similar well-log values but in contrast are 60–100 ft (18–30 m) thick and have upward-coarsening, blocky, and digitate wireline-log responses. Moreover, they partially overlap and extend 8–12 mi (13–19 km) basinward of the Saddle Creek shelf edge and record deposition of lowstand shelf-edge deltas fed by incised-valley systems. Digitate areal facies were also deposited in the on-shelf area, are primarily upward coarsening, and represent thinner (10–30 ft [3–9 m] thick).
highstand deltas. Incised-valley-fill, lowstand-delta, and highstand-delta sandstone facies are significant hydrocarbon producers in the Eastern Shelf. Mapping of shelf-edge lowstand deltas of the Tannehill and other Cisco Group sandstones record an aspect of the shelf-edge evolution of the Eastern Shelf. These deltas formed depositional platforms over which the next younger limestone (in this case, the Stockwether Limestone) transgressed across the shelf. As a result, the western (basinward) limit of the lowstand-delta platforms marks the shelf edge of these overlying limestones.